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PHOTO: PATRICIA SAINT-GERMAIN, BIML

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Editorial

ALAN E. JOHNSTON
CIML PRESIDENT

Happy New Year 2007!

This past year has been a successful one for the OIML with notable progress in a number of areas. The first two Declarations of Mutual Confidence under the MAA were signed for R 60 and R 76 and, in November 2006, the OIML signed a Memorandum of Understanding (MoU) with the International Laboratory Accreditation Cooperation (ILAC). The MoU will provide access to international experts for laboratories seeking accreditation for legal metrology activities. We have also made excellent progress in the development of a joint action plan with the BIPM while continuing to work jointly with them on a number of other projects.

The 41st CIML Meeting held in Cape Town, South Africa in October 2006, was very productive as CIML Members approved 11 Recommendations, elected a new second Vice-President (Dr. Grahame Harvey of Australia) and appointed Mr. Willem Kool as a new BIML Assistant Director. In Cape Town I committed to improving the structure and process of our annual meeting so it more fully meets Members' needs, while building on the success of past events. I want to encourage all Members to provide suggestions on how to enhance the effectiveness of this event. Your feedback is important!

The next twelve months will involve building on past successes and meeting new challenges. I hope to increase cooperation with other international organizations such as the United Nations Industrial Development Organization (UNIDO) and the International Accreditation Forum (IAF) as well as finalizing the OIML Long Term Strategy paper and presenting the associated Action Plan for CIML approval in Shanghai this year.

I want to thank everyone who helped accomplish so much over the past twelve months and look forward to working with you on our many initiatives in 2007. Have a prosperous and enjoyable New Year! ■

Bonne Année 2007 !

Cette dernière année a été très fructueuse pour l'OIML, compte tenu des progrès importants réalisés dans de nombreux secteurs. Les deux premières Déclarations de Confiance Mutuelle en vertu de l'Arrangement d'Acceptation Mutuelle (MAA) ont été signées pour la R 60 et la R 76 et, en novembre 2006, l'OIML a signé un protocole d'accord (MoU) avec la International Laboratory Accreditation Cooperation (ILAC). Le MoU permet d'avoir accès à des experts internationaux aux laboratoires recherchant une accréditation pour des activités de métrologie légale. Nous avons également fait des progrès importants dans l'élaboration d'un plan d'action conjoint avec le BIPM tout en continuant de travailler ensemble sur d'autres projets.

La 41ème réunion du CIML qui a eu lieu au Cap en Afrique du Sud, en octobre 2006, a été très productive, car les Membres du CIML ont approuvé 11 Recommandations, élu un nouveau Second Vice-président (M. Grahame Harvey d'Australie) et nommé M. Willem Kool au poste d'Adjoint au Directeur du BIML. Au Cap, je me suis engagé à améliorer la structure et les processus de notre réunion annuelle de façon à mieux répondre aux besoins des Membres, tout en m'inspirant des succès des événements antérieurs. J'encourage tous les Membres à fournir des suggestions sur les façons d'améliorer l'efficacité de cette réunion. Votre retour d'information est important !

Les douze prochains mois seront consacrés à tirer profit des succès antérieurs et à relever de nouveaux défis. J'espère pouvoir augmenter la collaboration avec d'autres organisations internationales comme l'Organisation des Nations Unies pour le Développement Industriel (ONUDI) et l'International Accreditation Forum (IAF) en plus de terminer le document sur la Stratégie à Long Terme de l'OIML et de présenter le Plan d'Action qui en découle pour approbation par le CIML à Shanghai cette année.

Je tiens à remercier tous ceux qui ont contribué à la réalisation de tant de choses au cours des douze derniers mois et je me réjouis à l'idée de travailler avec vous à nos nombreux projets en 2007. Que la Nouvelle Année vous apporte santé, bonheur et prospérité ! ■

NAWI

Calibration of non-automatic weighing instruments

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Abstract

This paper describes the metrological requirements and the measurement methods for calibrating non-automatic weighing instruments. It also may be a useful guideline for operators working in calibration laboratories accredited in various fields and is also intended to enable metrology laboratories to prove a given expanded uncertainty using suitable procedures. Two examples of calibration methods are given: one for electronic weighing instruments and another for mechanical instruments (two pan balances and single pan balances). The methods described include information regarding the measurement standards used for calibration, environmental conditions, calibration procedures and the estimation of the measurement uncertainty.

Keywords: electronic weighing instrument, mechanical weighing instrument, multiple ranges, multi-interval instrument.

Introduction

Calibration methods and the evaluation of uncertainty described in the paper are in compliance with OIML R 76-1 [1] and the Guide to the expression of uncertainty in measurements (GUM [3]). The combined standard uncertainty results from both the type A and type B evaluations of the measurement uncertainty.

The environmental working conditions shall be suitable for the instrument to be calibrated. The room in which the balances are installed must be temperature and humidity controlled. It is not allowed to place balances near equipment that generates vibration or in a room where dust may affect them. Also, heat transmission by solar radiation through the windows shall be prevented.

A. Calibration of electronic balances

Before calibration, an electronic weighing instrument should be checked on site to make sure it functions adequately for the intended application. The preliminary operations are:

- identification of the weighing instrument (type, model, serial number, etc.);
- checking the leveling;
- ensuring that electrically powered instruments have been switched on for a period of a least one hour (preferably overnight) and have reached room temperature;
- ensuring that the pan of the weighing instrument is clean and in good condition;
- pre-loading the weighing instruments several times to near maximum capacity;
- adjusting the error close to Max, using internal or adequate external weights, to allow compensation for changing environmental factors such as temperature and, implicitly, air density.

Estimating the expanded uncertainty is based on:

- repeatability;
- resolution;
- eccentricity;
- the influence of temperature variations at the site of use;
- accuracy measurements;
- the standard weights used in the accuracy measurements;
- hysteresis.

1. Repeatability

At least ten repeated measurements must be performed. This test should be done at or near the nominal maximum capacity of the weighing instrument or using the largest load generally weighed in applications. In the case of a zero deviation between the weighings, the instrument shall be reset to zero, without determining the error of the zero indication [1]. The uncertainty due to repeatability of the weighing process, u_w, is given by the standard deviation s of several weighing results obtained for the same load under the same conditions. For multiple range instruments, this test shall be carried out for each range used, thus for n measurements:

$$u_W = s = \sqrt{\frac{\sum_{i=1}^{n}\left(I_i - \overline{I}\right)^2}{n-1}} \tag{1}$$

where I_i is the indication of the weighing instrument and n is the number of repeated weighings:

$$\overline{I} = \frac{1}{n}\sum_{i=1}^{n} I_i \tag{2}$$

2. Resolution

For balances having a resolution d (equal to the scale interval), the uncertainty of the rounding error, u_r, for each reading I is [2]:

$$u_r = \frac{d/2}{\sqrt{3}} = \frac{d}{\sqrt{12}} \tag{3}$$

The uncertainty of the rounding effect for $I \neq 0$ is given by [6]:

$$u_r = \sqrt{\frac{d_{I=0}^2 + d_{I=L}^2}{12}} \tag{4}$$

Equation (4) is used for single and multiple range instruments. For multi-interval instruments, for the different scale intervals d_i, the uncertainty due to the rounding effect is:

$$u_r = \sqrt{\frac{d_1^2 + d_i^2}{12}} \tag{5}$$

where: d_1 is the smallest scale interval;
d_i is the scale interval of the appropriate partial range.

3. Eccentricity

It is preferable to use large weights instead of several small weights. The load L shall be applied on the pan in the positions indicated in Fig. 1 in a sequence of center, front, left, back, right, or equivalent.

After the first measurement, tare setting may be done when the instrument is loaded. For instruments having no more than four points ($n \leq 4$) of support, the test load is 1/3 Max. [1].

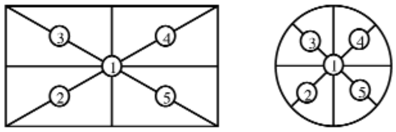

Figure 1

The load is first placed in position 1 and is subsequently placed in the other 4 positions in an arbitrary order. An acceptable solution for uncertainty due to eccentricity, u_{ex} is estimated as follows [2]:

$$u_{ex} = \frac{\Delta}{2\sqrt{3}} \tag{6}$$

Here, Δ is the largest difference between off-center and central loading indications.

The eccentric test is not carried out in the case of weighing instruments with a suspended load receptor.

4. Effect of temperature variations

The effect of temperature variations during the calibration, u_T is calculated from:

$$u_T = \frac{1}{\sqrt{12}}(\Delta_t \cdot TK \cdot 10^{-6}) \cdot L \tag{7}$$

where: TK is the effect of temperature on the mean gradient of the characteristic in ppm/K (estimated or taken from the data information sheet);

$\Delta_t = t_{max} - t_{min}$ is the temperature variation during the calibration, for load L.

5. Mass standards

The weights used as measurement standards shall comply with the specifications in OIML R 111 [2]. The traceability of the standards to the SI unit shall be ensured. The standards shall be adequately acclimatized before the calibration (to minimize the effect of convection). A thermometer kept inside the box with standard weights may be helpful to check the temperature difference.

- When the indication of the instrument is not corrected for the errors of the weights (the calibration weights are introduced as nominal values) the uncertainty of the reference weights, u_{ref} is estimated as follows:

$$u_{ref} = \frac{\delta_i}{\sqrt{3}} \tag{8}$$

or, when two or more weights are used,

$$u_{ref} = \frac{\sum \delta_i}{\sqrt{3}} \tag{8'}$$

where: δ_i is the maximum permissible error of the "*i*" applied weights.

- When the indications of the instruments are corrected for the errors of the weights (the calibration weights are introduced as conventional values) the standard uncertainty from the calibration certificate (u_{cert}) should be combined with the uncertainty due to the instability of the mass of the reference weight (u_{stab}) as follows [2]:

$$u_{ref} = \sqrt{u_{cert}^2 + u_{stab}^2} = \sqrt{\left(\frac{U}{k}\right)^2 + u_{stab}^2} \tag{9}$$

When two or more weights are used for *L*, the equation becomes:

$$u_{ref} = \sqrt{\Sigma u_{i\,cert}^{2} + \Sigma u_{i\,stab}^{2}} = \sqrt{\left(\frac{\Sigma U_i}{k}\right)^2 + \Sigma u_{i\,stab}^{2}} \tag{9'}$$

U_i (k=2) is the uncertainty of the applied weights from the calibration certificate.

The calculation of the uncertainty associated with the stability of the standard (u_{stab}) or ($\sum u_{istab}$) has to take into account a change in value between calibrations, assumed a rectangular distribution. This component would be equivalent to the change in value between calibrations divided by $\sqrt{3}$:

$$u_{stab} = \frac{D_{max}}{\sqrt{3}} \tag{10}$$

where: D_{max} represents the drift determined from the previous calibrations.

If previous calibration values are not available, the uncertainty from the calibration certificate is considered to be an uncertainty associated with the drift.

6. Accuracy measurements and linearity

6.1 Accuracy measurements

Weighing instruments should be calibrated throughout their range. When a weighing instrument is used only over a part of its capacity, the calibration may be restricted to this part of the measuring range. In this case, the part of the range that has been calibrated has to be explicitly mentioned in the calibration certificate and also a label with this information should be affixed to the weighing instrument.

Measurements are made at about five equal steps across the range of the balance (zero, 0.25 Max, 0.50 Max, 0.75 Max and Max). If the balance is typically used for a particular load, the accuracy of the scale around this load should be measured.

- When:
  - the weighing instrument was adjusted before measurement,
  - the density of weights is close to 8000 kg/m^3, and
  - the air density is close to 1,2 kg/m^3,

the indication error, E_I is obtained from the difference between the instrument reading *I* - upon application of a load *L* - and the value of this load (conventional mass value or nominal value).

$$E_I = I - L \tag{11}$$

The weights are applied in increasing and decreasing loads. The estimation of the uncertainty associated with the indication error takes into account the influences of repeatability (u_w), resolution (u_r), reference weights (u_{ref}), temperature (u_T) and hysteresis (u_H).

Hysteresis occurs when a balance displays a different reading for the same load, when the load is applied whilst increasing and decreasing the weight.

If the difference is δ_x, the standard uncertainty due to hysteresis, is given by F.2.2 in [3]:

$$u_H = \frac{\delta_x}{\sqrt{12}} = 0{,}29\,\delta_x \tag{12}$$

The expression of uncertainty associated with the determining the indication error is:

$$u_{(EI)} = \sqrt{(u_w)^2 + (u_r)^2 + (u_{ref})^2 + (u_T)^2 \cdot L^2 + (u_H)^2} \tag{13}$$

The uncertainty u_{EI} should be calculated for each value of the load used.

From (13), the relative standard uncertainty can be calculated as:

$$u_{(EI)\,rel} = u_{(EI)} / L \tag{14}$$

and the largest uncertainty $u_{(EI)\ rel\ max}$ is taken into account for further calculations. The indication error is not the same when the weighing instruments are calibrated using standard weights under different conditions. In this case, the error of indication is:

$$E = I - (L+BC) = I - L - BC =$$

$$= \quad I - L - \left[-L \cdot \left[(\rho_a - \rho_0) \cdot \left(\frac{1}{\rho_w} - \frac{1}{\rho_c}\right) + \frac{\rho_a - \rho_{a_{adj}}}{\rho_c} \right] \right] =$$

$$= I - L + L \cdot \left[(\rho_a - \rho_0) \cdot \left(\frac{1}{\rho_w} - \frac{1}{\rho_c}\right) + \frac{\rho_a - \rho_{a_{adj}}}{\rho_c} \right] \tag{15}$$

Where BC, the buoyancy correction, is equal to [8]:

$$BC = -L \cdot \left[(\rho_a - \rho_0) \cdot \left(\frac{1}{\rho_w} - \frac{1}{\rho_c}\right) + \frac{\rho_a - \rho_{a_{adj}}}{\rho_c} \right] \tag{16}$$

where: ρ_w = density of the weight;
ρ_a = density of the air during the calibration;
ρ_0 = 1,2 kg/m^3 is the reference density of the air;
ρ_c = reference (conventional) density of the adjustment weight equal to 8000 kg/m^3;
$\rho_{a\ adj}$ = air density at the time of adjustment.

Provided that:

- the instrument has been adjusted immediately before the calibration, $\rho_{a\ adj} = \rho_a$, the buoyancy correction may be calculated as:

$$BC = -L \cdot (\rho_a - \rho_0) \cdot \left(\frac{1}{\rho_w} - \frac{1}{\rho_c}\right) \tag{16'}$$

- the instrument has been adjusted independently of the calibration ($\rho_{a\ adj}$ is unknown) the buoyancy correction may be calculated as:

$$BC = -L \cdot \frac{\rho_a - \rho_0}{\rho_w} \tag{16''}$$

with the following assumptions: $\rho_{a\ adj} = \rho_0$ and $\rho_w = \rho_c$

Starting from (16') and (16''), the relative standard uncertainty associated with the buoyancy correction (u_{BC}) may be calculated as:

$$u_{BC}^2 = u_{\rho_a}^2 \cdot \left(\frac{1}{\rho_w} - \frac{1}{\rho_c}\right)^2 + (\rho_a - \rho_0)^2 \cdot \frac{u_{\rho_w}^2}{\rho_w^4} + u_{\rho_a}^2 \cdot \frac{u_{\rho_w}^2}{\rho_w^4} \tag{17}$$

$$u_{BC}^2 = \frac{u_{\rho a}^2}{\rho_w^2} + (\rho_a - \rho_0)^2 \cdot \frac{u_{\rho_w}^2}{\rho_w^4} \tag{18}$$

The uncertainty of the air density, $u(\rho_a)$ is determined according to [2]. When the air density is not measured and the average air density for the site is used instead, the uncertainty associated with the air density is estimated (according to chapter C.6.3.4 in [2]) as:

$$u(\rho_a) = \frac{0{,}12}{\sqrt{3}} \ [\text{kg/m}^3] \tag{19}$$

The expression of uncertainty associated with the indication error (when the buoyancy correction is applied) is:

$$u_{(EI)} = \sqrt{(u_w)^2 + (u_r)^2 + (u_{ref})^2 + (u_T)^2 \cdot L^2 + (u_H)^2 + (u_{BC})^2 \cdot L^2} \tag{20}$$

The uncertainty $u_{(EI)}$ should be calculated for each value of the load used.

From (20), the relative standard uncertainty can be calculated as:

$$u_{(EI)\ rel} = u_{(EI)} / L \tag{21}$$

and the largest uncertainty $u_{(EI)\ rel\ max}$ is taken into account.

6.2 Linearity

Linearity is defined as "the deviation from the theoretically straight-lined linear slope of two interdependent values. For weighing instruments this means the positive or negative deviation of the readout from the actual load, when the zero point and the span have been correctly adjusted" [10].

The linearity and accuracy measurements can be performed together or independently. Combining the accuracy and linearity tests is possible because linearity is often considered to be a component of the accuracy measurements. The linearity can be determined by weighing two stable objects separately, each of approximately one half the weighing capacity. The sum of the two readings should be equal to the reading obtained when both objects are weighed together.

Uncertainty of measurement for the weighing instrument

The influences of the repeatability and of the rounding error are assumed to be independent of the load applied, while all the other components are proportional to the weight values. The standard uncertainties corresponding to the components that are proportional to the weight values are expressed as relative uncertainties. The combined standard uncertainty u_c is based on the parameters described above (which can be grouped to obtain a simplified expression that would better reflect the fact that some of the terms are independent from the applied load, while others are proportional to the weight value) [5]:

$$u_c = \alpha + \beta \cdot L \tag{22}$$

- When corrections are applied to the error of indication of the weighing instrument, the expression for the combined standard uncertainty u_c is:

$$u_c = \sqrt{u_w^2 + u_r^2} + \sqrt{L^2 \cdot (u_{exrel}^2 + u_{Trel}^2 + u_{(EI)rel\max}^2)}$$
$$= \sqrt{u_w^2 + u_r^2} + L \cdot \sqrt{u_{exrel}^2 + u_{Trel}^2 + u_{(EI)rel\max}^2} \qquad (23)$$

u_{Trel} from (23) is calculated by replacing the temperature variation during calibration (from (7)) with the actual temperature variation recorded during the use of the balance.

- When no corrections are applied to the error of indication of the weighing instrument, the largest relative indication error across the range that is measured $E_{I\,rel\,(Max)}$ should be added to u_c, in addition to $u_{(EI)rel(max)}$, as follows:

$$u_c = \sqrt{u_w^2 + u_r^2} + \sqrt{L^2 \cdot [u_{exrel}^2 + u_{Trel}^2 + (u_{(EI)rel\max} + E_{I\,rel(Max)})^2]}$$
$$= \sqrt{u_w^2 + u_r^2} + L \cdot \sqrt{u_{exrel}^2 + u_{Trel}^2 + (u_{(EI)rel(Max)} + E_{I\,rel(Max)})^2} \qquad (24)$$

The expanded uncertainty for k=2 is:

$$U = k \cdot u_c \qquad (25)$$

B. Calibration of mechanical balances

B1. Two pan balances

The balances with two pans and three knife edges are also known as equal-arm balances because the knife edges supporting the pans are nominally equidistant from the central knife edge. The three knife edges are parallel and lie in the same horizontal plane.

Two-pan balances are generally undamped with a "rest point" being calculated from a series of "turning points". Some balances incorporate a damping mechanism (usually mechanical or magnetic) to allow the direct reading of a "rest point". In all cases, the reading in terms of scale units needs to be converted into a measured mass difference.

An undamped two-pan balance is used less frequently mainly due to the amount of time needed to carry out a weighing compared with electronic balances.

There are two methods to calculate the "rest point" (the equilibrium positions) "P" for balances (the accuracy of the second is better than that of the first one):

$$P = (e_1 + 2e_2 + e_3)/4 \quad \text{or} \qquad (26)$$

$$P = (e_1 + 3e_2 + 3e_3 + e_4)/8 \qquad (27)$$

where $e_1 \ldots e_4$ are consecutive readings at the extremity of the swing of the pointer, i.e. where it changes its direction of motion.

A calibration procedure [7] is shown in Table 1.

No	Loads applied on receivers		Readings			Equilibrium position		Difference Δ_i div
			e_1	e_2	e_3	div	div	
	left	right						
1	0	0				P_1		
2	L_1	L_2					P_2	
3	L_2	L_1				P_3		
4	L_2	L_1+sw$_1$					P_4	
5	0	0				P_5		
6	L_3	L_4					P_6	
7	L_4	L_3				P_7		
8	L_4+sw$_2$	L_3					P_8	
9	0	0				P_9		
10	L_3	L_4					P_{10}	$\Delta_1 = P_{10}-P_9$
11	0	0				P_{11}		
12	L_3	L_4					P_{12}	$\Delta_2 = P_{12}-P_{11}$
13	0	0				P_{13}		
14	L_3	L_4					P_{14}	$\Delta_3 = P_{14}-P_{13}$
15	0	0				P_{15}		
16	L_3	L_4					P_{16}	$\Delta_4 = P_{16}-P_{15}$
17	0	0				P_{17}		
18	L_3	L_4					P_{18}	$\Delta_5 = P_{18}-P_{17}$
19	0	0				P_{19}		
20	L_3	L_4					P_{20}	$\Delta_6 = P_{20}-P_{19}$

Table 1 Calibration procedure for two-pan balances

where:

- sw_1 and sw_2 are additional small weights (sensitivity weights) with mass m_{sw}, used to determine the scale interval of the balance. These sensitivity weights should be calibrated against suitable mass standards;
- L_1 and L_2 are weights with nominal masses equal to the minimum capacity of the balance;
- L_3 and L_4 are weights with nominal masses equal to the maximum capacity of the balance.

The following tests and calculations should be carried out on a regular basis and are essential to the routine operation of the balance [7]:

1 Determining the scale interval while the balance is loaded with minimum capacity:

$$d_{min} = m_{sw1} / |P_4 - P_3| \qquad (28)$$

2 Determining the scale interval while the balance is loaded with maximum capacity:

$$d_{max} = m_{sw2} / |P_8 - P_7| \qquad (29)$$

3 Determining repeatability while the balance is not loaded and loaded with maximum capacity (by determining the experimental standard deviations):

$$R_0 = \sqrt{\frac{\sum_{i=1}^{n}(P_{oimed} - P_{oi})^2}{n-1}} \; ; R_{max} = \sqrt{\frac{\sum_{i=1}^{n}(\Delta_{imed} - \Delta_i)^2}{n-1}} \qquad (30)$$

where: P_{0i} are the equilibrium positions while the balance is not loaded;

$P_{0i\ med}$ are the mean of equilibrium positions while the balance is not loaded;

Δ_i are the differences between equilibrium positions of the balance when it is not loaded and when it is loaded with maximum capacity;

$\Delta_{i\ med}$ is the mean of the Δ_i differences.

4 Determining errors due to the fact that the two arms of the balance are not equal in length (this test is not applicable to balances with a single pan, case B2, section to be discussed).

$$J_{min} = \frac{P_2 + P_3}{2} - \frac{P_1 + P_5}{2} \tag{31}$$

$$J_{max} = \frac{P_6 + P_7}{2} - \frac{P_5 + P_9}{2} \tag{32}$$

Uncertainty of measurement for the weighing instrument

The standard uncertainty is based on the parameters described above as follows:

- uncertainty due to the sensitivity of the balance:

$$u_{s\ min} = d_{min} \cdot \sqrt{\left(\frac{u_{sw1}}{m_{sw1}}\right)^2 + \left(\frac{u_{(P4-P3)}}{P_4 - P_3}\right)^2} \tag{33}$$

and

$$u_{s\ max} = d_{max} \cdot \sqrt{\left(\frac{u_{sw2}}{m_{sw2}}\right)^2 + \left(\frac{u_{(P_8-P_7)}}{P_8 - P_7}\right)^2} \tag{34}$$

where: u_{sw} is the uncertainty of the additional small weights *sw* (sensitivity weights);

$(P_4 - P_3)$ or $(P_8 - P_7)$ is the change in the indication of the balance (due to the sensitivity weights) with the uncertainties $u_{(P4 - P3)}$ or $u_{(P8 - P7)}$, respectively;

d is the scale interval.

From (33) and (34), the relative standard uncertainty can be calculated as:

$$u_{s\ rel} = u_{s\ (min,\ max)} / L \tag{35}$$

and the largest uncertainty $u_{s\ rel\ max}$ takes into account:

- the variance of repeatability:

$$u_w^2 = s^2 = R^2 \tag{36}$$

- the uncertainty due to the inequality of the two arm lengths:

$$u_J = \sqrt{\frac{u_{P6}^2}{4} + \frac{u_{P7}^2}{4} + \frac{u_{P5}^2}{4} + \frac{u_{P9}^2}{4} + u_w^2} \tag{37}$$

$$u_J = \sqrt{u_r^2 + (u_w \cdot d)^2} = \sqrt{\left(\frac{0{,}2 \cdot d}{2\sqrt{3}}\right)^2 + (u_w \cdot d)^2} = \tag{37'}$$

where: u_w^2 is the variance of the repeatability;

u_r^2 is the variance of limited resolution.

The resolution is equal to 1/10 or 2/10 of the scale interval d, the standard uncertainty being calculated as:

$$u_r = \frac{\frac{0{,}2d}{2}}{\sqrt{3}} = \frac{0{,}2d}{2\sqrt{3}} \tag{38}$$

Then, the combined standard uncertainty u_c can be calculated as follows:

$$u_c = \sqrt{(u_w \cdot d)^2 + u_J^2} + \sqrt{u_{s_{relmax}}^2 \cdot L^2} = \sqrt{(u_w \cdot d)^2 + u_J^2} + (u_{s_{relmax}} \cdot L) \tag{39}$$

The expanded uncertainty is reporting by multiplying u_c with the coverage factor k=2.

$$u_c = \sqrt{(u_w \cdot d)^2 + u_J^2} + \sqrt{u_{s_{relmax}}^2 \cdot L^2} = \sqrt{(u_w \cdot d)^2 + u_J^2} + (u_{s_{relmax}} \cdot L) \tag{40}$$

B2. Single pan balances

Displays on these balances tend to be of the optical variety, the sensitivity of the balance being usually adjusted by a skilled person.

In the case of single pan, direct reading analytical balances, the following tests and calculations should be carried out: repeatability, calibration of the screen and calibration of built-in weights.

1. Repeatability: this test should be done at or near the nominal maximum capacity of the weighing instrument or using the largest load generally weighed in applications. Repeatability is determined in the same way as was described in section B1 (30).

2. Calibration of the screen: one can determine the accuracy measurements for the entire screen by the application of standard weights at various points in the range of the screen (1/4, 1/2, 3/4 and 4/4) according to Table 2.

No	Load applied mg	Equilibrium positions P_1 mg	P_2 mg	P_3 mg	P_{med} mg	P_{0imed} mg	Diff Δ_i mg	Mass of sensitivity weight mg
1	0				P_1			
2	$sw_1 = 1/4$				P_2		$\Delta_1 = P_2 - P_{01}$	m_{sw1}
3	0				P_3	P_{01}		
4	$sw_2 = 1/2$				P_4		$\Delta_2 = P_4 - P_{02}$	m_{sw2}
5	0				P_5	P_{02}		
6	$sw_3 = 3/4$				P_6		$\Delta_3 = P_6 - P_{03}$	m_{sw3}
7	0				P_7	P_{03}		
8	$sw_4 = 4/4$				P_8		$\Delta_4 = P_8 - P_{04}$	m_{sw4}
9	0				P_9	P_{04}		

Table 2 Calibration of the screen

where:

$sw_1 \ldots sw_4$ are sensitivity weights having nominal mass equal to 1/4...4/4 from the maximum capacity of the screen;

m_{swi} is the mass of the sensitivity weight applied;

$P_{oi\ med}$ are the average equilibrium positions (rest points) while the balance is not loaded.

The indication error of the screen will be calculated as follows:

$$E_1 = \Delta_i - m_{swi} - \rho_a \cdot V_{swi} \tag{41}$$

where: ρ_a is the density of the air, and

V_{swi} is the volume of the sensitivity weight (with u_{Vsw} uncertainty).

3. Calibration of built-in weights: the built-in weights are used in combination during the operation of the balance. First of all, it is necessary to identify the built-in weights as nominal values. Ideally the weights built into the balance should be removed and calibrated externally. If this is not possible they can be left in the balance and calibrated by turning the dial to obtain the correct combinations. A standard weight S of mass m_s and volume V_s is chosen for calibration, depending on the accuracy of the balance.

   The steps for calibration of built-in weights are [9]:

   - record screen reading at no load indication I_1;
   - record screen reading I_2 when loading with standard weight S;
   - record screen reading I_3 when loading with standard S (with volume V_s) and a sensitivity weight of mass m_{sw} (with volume V_{sw});
   - record screen reading I_4 when the standard S is removed and only the sensitivity weight remains on the pan.

To calculate the mass of the built-in weight, the following formula can be applied:

$$BW = m_S - \rho_a \cdot V_S + \rho_a \cdot V_{BW} + K \cdot \left(\frac{I_1 + I_4}{2} - \frac{I_2 + I_3}{2}\right) \tag{42}$$

where: V_{BW} is the volume of the built in weight and

K is a factor used to convert the reading in terms of scale units into a measured mass difference.

$$K = \frac{m_{sw} - \rho_a \cdot V_{sw}}{I_3 - I_2} \tag{43}$$

Formula (42) can be reduced if the accuracy of the weighing allows, and if it is known that K is constant from the previous measurements:

$$BW = m_S - \rho_a \cdot V_S + \rho_a \cdot V_{BW} + K \cdot (I_1 - I_2) \tag{44}$$

The values for m_s, V_s, V_{sw}, m_{sw} are given in the calibration certificate.

Measurement uncertainty for the weighing instrument

To estimate the measurement uncertainty for the weighing instrument, the following parameters need to be considered:

1. Uncertainty due to the repeatability of the weighing instrument, u_w, given by the standard deviation s of several weighing results obtained for the same load under the same conditions, calculated as in (36).
2. Uncertainty associated with the indication error of the screen - calculated as follows:

$$u_{(EI)} = \sqrt{u_{sw}^{\ 2} + u_{\rho_a}^2 \cdot V_{sw}^2 + \rho_a^2 \cdot u_{Vsw}^2 + u_w^2 + u_r^2} \tag{45}$$

The above expression includes the parameters described: u_w (repeatability), u_r (resolution), $u_{\rho a}$ (uncertainty of the air density), u_{sw} (uncertainty of the sensitivity weight), V_{swi} (volume of the sensitivity weight with u_{Vsw} uncertainty).

3. Uncertainty of the built-in weights - calculated starting from (42) or (44):

$$u_{BW} = \sqrt{u_A^2 + u_S^2 + u_{\rho_a}^2 (V_{BW} - V_S)^2 + \rho_a^2 \cdot (u_{VBW}^2 + u_{V_S}^2) + u_K^2 \cdot \left(\frac{I_1 + I_4}{2} - \frac{I_2 + I_3}{2}\right)^2 + \frac{1}{2} K^2 \cdot u^2_{[(I_2 + I_3) - (I_1 + I_4)]}} \tag{46}$$

$$u_{BW} = \sqrt{u_A^2 + u_S^2 + u_{\rho_a}^2 (V_{BW} - V_S)^2 + \rho_a^2 \cdot (u_{V_{BW}}^2 + u_{V_S}^2) + u_K^2 \cdot (I_1 - I_2)^2 + K^2 \cdot u^2_{(I_1 - I_2)}} \tag{47}$$

Since an experimental standard deviation cannot be calculated for a single measurement to estimate u_A, data obtained from previous repeatability evaluations can be used, thus resulting in a pooled standard deviation.

The standard uncertainty of the reference weight, u_s is calculated according to (9) from above.

The combined standard uncertainty, u_c can be calculated as follows:

- When corrections are applied to the error of indication, the expression for the combined standard uncertainty u_c is:

$$u_c = \sqrt{u_w{}^2 + u_r{}^2 + u_{BW}^2 + (u_{(EI)})^2} \quad (48)$$

When no corrections are applied to the error of indication, the indication error across the partial screen range that is measured E_I should be added to u_c, in addition to $u_{(EI)}$, as follows:

$$u_c = \sqrt{u_w{}^2 + u_r{}^2 + u_{BW}^2 + (u_{(EI)} + E_I)^2} \quad (49)$$

The expanded uncertainty for k=2 will be:

$$U = k \cdot u_c \quad (50)$$

Conclusions

This paper has described the metrological requirements for the calibration of non-automatic weighing instruments and has aimed to provide useful information for operators working in accredited calibration laboratories in various fields, in order to determine the mass of products.

- A laboratory should not attempt to perform measurements with an uncertainty of "x" using an instrument that has the readability "x". If the user wishes to apply no corrections, to obtain an uncertainty of "x", he or she should have a balance with a readability of "0.1 x", to be sure that no gross errors are present.
- The balance indications are closer to the conventional mass than to the true mass, on many occasions the indication being directly used as the conventional mass. This is normally not valid for mass (true mass). In current use, it is necessary to convert the weighing result from the conventional mass to the true mass (in section B2 above, the weighing result is transformed directly in true mass).
- When a calibrated instrument is used, the calibration uncertainty stated in the calibration certificate of that instrument has to be taken into account when reporting the measurement uncertainty associated with any measurement results, but it should be remembered that the calibration uncertainty represents only one part of the measurement uncertainty stated in current applications of the laboratory.

Other contributions to the measurement uncertainty that have to be taken into account are the influence of the buoyancy correction, the influence of the properties of the product that is weighed (evaporation, hygroscopic behavior, electrostatic charging, etc.).

- Mechanical balances have generally been replaced by electronic balances, which often offer better resolution and are easier to use. The recalibration period for both mechanical and electronic balances can be different for each type, being influenced by such factors as the usage of the load receptor, operator skill and the environment in which the balance is located. As a general guideline the balance should be recalibrated yearly, until the stability of operation is established. ■

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LINE STANDARDS

Method for calibrating line standards with marks, with nominal length up to 1000 mm: Uncertainty budget

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Abstract

This paper describes a modern method used for the calibration of line standards with marks using a longitudinal comparator with an He-Ne frequency-stabilized laser source, and the subsequent estimation of the errors which occur during the measurement of line standards with such a longitudinal comparator. The author's contribution consists of:

- the analyses of the sources of error which occur during the measurement due to the line standard, longitudinal comparator, electronic equipment and temperature;
- the estimation of the measurement uncertainty budget according to the specifications of the GUM [1]; and
- finding a better longitudinal comparator construction solution to increase the performance of the measurement of line standards, consisting in replacing the optical microscope with a modern viewing model equipped with a CCD camera and custom software for capturing and analyzing the image.

Key words: line standard with marks, longitudinal comparator for line standards, uncertainty budget

Introduction

To increase the measurement accuracy of standard reference lines, the Romanian Length Laboratory at the INM has attempted to improve the performance of installations used to measure standard lines. For this purpose, an ensemble microscope equipped with a CCD camera has replaced the old optical microscope, and software which can magnify the image 50 to 400 × has been used to capture and analyze the image. In order to reduce vibrations, the installation is mounted on a pneumatic suspension.

This article also presents the evaluation of components of standard uncertainties and the estimation of the uncertainty budget, and offers several solutions to counter the increase in the uncertainty of measurement.

1 Method of calibration

In Romania, the transmission of the unit of length to standard lines of high accuracy is done using a longitudinal comparator with an He-Ne laser source, stabilized in frequency, presenting the following advantages:

- It uses as a measurement unit the wavelength of an He-Ne laser stabilized in frequency that can take the measurement unit directly from the national standard of length. The laser is connected to the cesium standard of frequency and the velocity of light in a vacuum;
- There is high reproducibility of the measurement unit (10^{-10}...10^{-8});
- It has a digital resolution with small increments (from 0.01 µm to 0.1 µm); and
- There is a facility to align the laser with the measurement direction.

For the validation of the method, a metal line of marks was used (made by SIP Switzerland, serial no. 46 with H section) which was calibrated by the BIPM in 1987. The results obtained using the interferential comparator were compared with the results from BIPM certificate no. 1/1988. The results of the measurement are given in Table 1.

The results obtained by the INM Length Laboratory take into account the limits of measurement uncertainty, declared by the INM for measurement capability in Euromet comparisons.

The longitudinal comparator is a unique reference standard installation, designed and built by the Length Laboratory. It is based on the cinematic method according to the Abbe principle: the reference line measures must be aligned on the same longitudinal axis as the laser beam in the measurement direction, with the objective of eliminating first order errors. During the measurements, the line is placed in a closed box situated on the granite plane base that offers a constant temperature and ensures insulation according to the ambient temperature of the room. The installation is equipped with a view microscope (made by Hirox Japan, type CX-5040SZ), which permits the magnification of

Table 1 Comparative results between the BIPM and INM certificates

Nominal length mm	Measured length at the BIPM mm	Measured length at the INM mm	Differences between INM certificate and BIPM certificate µm
100	100,01131	100,01122	0,09
200	200,03072	200,03061	0,19
300	300,04632	300,04629	0,03
400	400,06209	400,06219	- 0,10
500	500,07379	500,07361	- 0,18
600	600,09246	600,09239	- 0,07
700	700,11190	700,11182	- 0,08
800	800,12264	800,12269	- 0,05
900	900,14423	900,14434	- 0,11
1000	1000,15723	1000,15720	- 0,03
Uncertainty measurement INM			
$0.2\ \mu m + 0.5 \cdot 10^{-6} L$, L in meters			

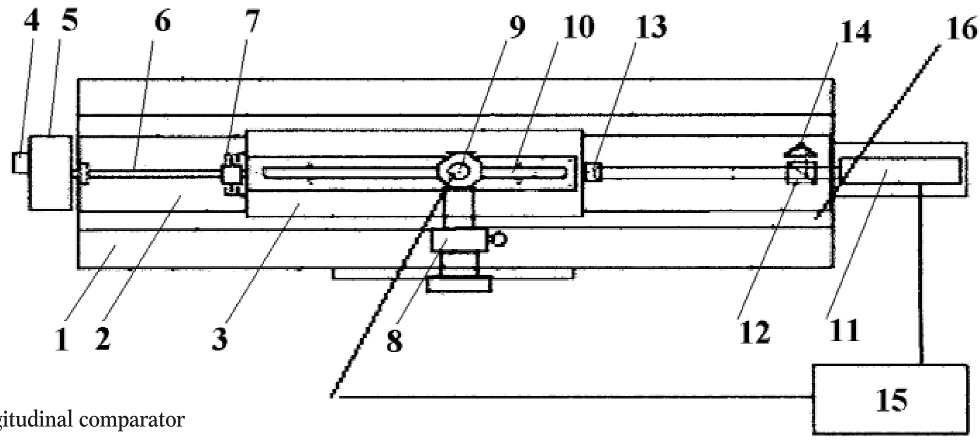

Fig.1 The longitudinal comparator

1 Granite plane base supported on the pneumatic suspension
2 Rectitude guide line, section I
3 Carriage for line, on the pneumatic gas suspension
4 Pneumatic gas skids of the carriage
5 Variable speed motor with shift reduction unit
6 Rolling screw for carriage displacement
7 Screw and gaze static system for coupling nut on the carriage
8 Microscope support
9 Microscope for viewing the marks of lines and CCD Camera
10 Reference line measure to calibrate
11 Stabilized frequency He-Ne laser
12 Michelson interferometer
13 Measuring retro reflector
14 Reference retro reflector
15 Electronic system control and data acquisition - PC for data laser system
16 Closed box

the image from 50 to 400 × and a field of view from 6,1 mm to 0,78 mm, a CCD camera (made by Lumenera Scientific, Canada) with a maximum resolution of 1280 × 1024 pixels and software for the image capture. The interferometer comparator is presented in Fig. 1.

The view microscope has a vertical optical axis and is fixed on the granite plane base with a rigid support, equipped with vertical and transversal adjusters for viewing the line marks.

The frequency stabilized laser interferometer permits the measurement of the displacement of the line by counting the interferential fringes which appear in the Michelson interferometer when the mobile mirror of the interferometer is displaced from the carriage that supports it. The measurement method is a direct comparison method.

The measurement method consists in displacing the reference line measure along the measurement direction. The speed of displacement is about max. 10 mm/min. Viewing of the marks line measure is done using a view microscope with a CCD camera and is captured with special custom-designed software for this equipment. The image of the mark appears magnified on the computer monitor. The line is put on the mobile arm of the interferometer and the distance between marks is directly measured in length units.

The appearance of a fringe in the view field of the interferometer is determined by a deviation of the optical path from the measurement arm of the interferometer equal to $\lambda/2$, where λ is the wavelength in the propagating medium at the medium's temperature, pressure and humidity of the He-Ne radiation laser, used as a monochromatic light source.

The measured length of the line standard is determined by the formula:

$$L_{20\ °C,\ 760\ torr} = L_{tp} + (\Delta L)_{\lambda} + \alpha L_n(20 - t), \quad (1)$$

where:

$L_{20\ °C,\ 760\ torr}$	line length at 20 °C and pressure of 760 torr;
L_{tp}	measured length displaced by electronic block under measurement conditions (pressure p, temperature t);
α_H	thermal coefficient of expansion of the line; $\alpha = 8{,}302 \cdot 10^{-6}\ °C^{-1}$;
L_n	nominal length in meters;
t	line temperature indicated by electronic thermometers for $U = 0{,}05$ °C and resolution 0,01 °C;
$(\Delta L)_{\lambda}$	correction of the wavelength due to the medium conditions.

2 Study of the errors which appear at the line standards measurement using a longitudinal comparator

These errors can be caused by:

- The geometry of the measurement system, such as the comparator and viewing microscope or the CCD camera apparatus;
- The line standard (supporting of the line, thermal coefficient of expansion);
- Temperature errors; and
- The laser source.

2.1 Geometrical errors

Geometrical errors are produced by:

a) Deviations from the ideal geometrical model, which supposes that the line axis and the microscope axis are in the same vertical plane, which means that viewing the marks should be done perpendicular to the mark (see Fig. 2).

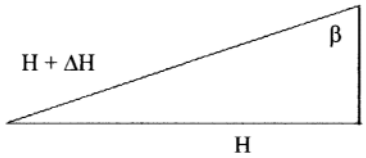

Fig. 2

By placing the line on the view axis of the laser interferometer, Abbe's principle is respected, so the errors produced by the deviations from the rectilinear of the carriage carrier (line displacement) are only second order errors. If the viewing axis is tilted about $\beta = 5'$ from the normal, for a focusing height of the image of 6 mm, the error is equal to:

$H = (H + \Delta H)\sin\beta$

$H = 0.008$ mm

But this error is systematic and constant all along the line, so it can be eliminated.

b) The maximum rectilinear error (δl_r) of the guide which supports the carrier line carriage is no more than 3 µm/m all along the guide. If one considers the deviations from the rectilinear of the guide to be about 3 µm/m, the measurement errors will be very small, about $4 \cdot 10^{-7}$ mm, as in Fig. 3.

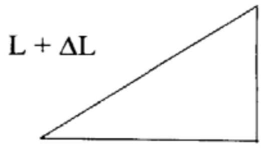

Fig. 3

$L = 1$ m – line length

$$L + \Delta L = 1000{,}0000004 \text{ mm} \quad (2)$$

$(\delta l_r) = 0$

c) Error due the winding of the guide (δl_s)

From experimental evaluations, a maximum winding of 0.5 µm / 1m results, which introduces a measurement error equal to 0.12 µm.

d) Viewing error of the microscope (δl_{vm})

Viewing of the line marks is done using the microscope and the magnification of the image of the mark is projected on the computer's monitor. The CCD camera permits a magnification from 50 to 400 ×. If one considers the width of the mark as being equal to 0.01 mm, for a magnification of 200 ×, this will be projected on the screen with a width of 2 mm. Because of the resolution of the camera (1280 × 1024 pixels) the framing of the middle of the mark can be done with an uncertainty better then 0.004 µm, for a rectangular distribution.

e) Due to the electric motor which displaces the line carrier - line ensemble (δl_v)

During the measurement process, vibrations can occur which can lead to non alignment of the line. Under experimental conditions, a vibration value smaller than 0.5 nm was obtained.

2.2 Errors due to the line standards

a) Error due to the setting of the line

The supporting mode of the line, universally adopted, consists in setting the line on two supports, one fixed and one mobile, adjustable in height and length, to permit the setting of the line in Bessel points, situated at 0.2203 L from the edges. This setting ensures the minimum shortage of the line and a negligible error due to the deformation of the line.

b) Error due to the non uniformity of the thermal coefficient of expansion of material of the line

At 20 °C, the thermal coefficient of expansion has a value equal to $8.302 \cdot 10^{-6}$ °C^{-1}. Its variation along the line has $\Delta\alpha = 0.5 \cdot 10^{-6}$ °C^{-1} limits. The line temperature measured inside the closed box is 20 °C ± 0.03 °C.

The assignment uncertainty for a rectangular distribution is:

$$(\Delta\alpha \cdot \Delta t)/\sqrt{3} = 0{,}5 \cdot 10^{-6}\ °\mathrm{C}^{-1} \cdot 0{,}03\ °\mathrm{C}/1{,}73 = 0{,}0087 \cdot 10^{-6} \quad (3)$$

2.3 Errors due to the temperature

These types of errors come from the calibration of thermometers, reading errors (resolution of thermometers) and the non uniformity of the temperature along the line.

The expanded measurement uncertainty of the thermometers, according to the calibration certificate, is equal to $U_t = 0.05$ °C. For an extended factor $k = 2$ and a normal distribution type B, the standard uncertainty is equal to: $u_t = 0.025$ °C;

The measurement uncertainty due to the thermometer's resolution, for a trapezoidal distribution, is equal to:

$$u_c = 0.01°\mathrm{C} / \sqrt{12} = 0{,}003\ °\mathrm{C} \quad (4)$$

The measurement uncertainty due to the non uniformity of the temperature along the line, for $\Delta t = 0{,}03$ °C and $\alpha = 8.302 \cdot 10^{-6}$ °C^{-1} and for a rectangular distribution is:

$$u_g = \alpha L \Delta t / \sqrt{3} = 0.08 \cdot 10^{-6}\ L/1.73 = 0.143 \cdot 10^{-6}\ L \quad (5)$$

2.4 Errors due to the laser interferometer

a) Error due to the influence of environmental parameters on the refractive index

Corrections to the wavelength of the interferometer's radiation are determined by environmental conditions in which the laser radiation travels, respective of temperature, pressure and environmental humidity, according to the Owens-Edlen formula:

$$(\Delta L)_\lambda = (1 - n/n_N) \cdot L \quad (6)$$

where:

L measured length;

n refractive index of air;

n_N refractive index of air at t = 20 °C;

p = 760 torr; and

u = 10 torr (pressure of water vapor in air).

Considering that the measurement uncertainty of the wavelength depends on the measurement uncertainty of the pressure and the temperature, for the Hewlett Packard laser interferometer this gives the following values: u_p = 1.12 torr; u_t = 0.2 °C; u_u = 0.1 torr.

The wavelength of the laser at t = 20 °C, p = 760 torr and u = 10 torr is λ = 0,6328 µm.

For t = 20.2 °C, p = 761.12 torr and u = 10.1 torr, applying the Owens-Edlen formula results in the following value for the wavelength of the laser:

$$(\Delta L)_\lambda = 0.021566 \cdot 10^{-6} L \quad (7)$$

where L is measured in meters.

This results in the fact that the measurement error of the wavelength according to the measurement uncertainty due to the environmental parameters (u_p = 1.12 torr, u_t = 0.2 °C, u_u = 0.1 torr) is equal to $0.22 \cdot 10^{-6} L$, where L is measured in meters.

b) The error due to the flatness deviation of the retroreflectors' mirrors is equal to $\lambda/8$ = 0.08 µm.

c) Cosines error between incident laser beam and reflective laser beam

Experimentally, a maximum error was obtained equal to $0.002 \cdot 10^{-6} L$, where L is measured in meters.

Table 1 Comparative results between the BIPM and INM certificates

Uncertainty source	Uncertainty compound	Distribution of probability	Sensitive coefficient	Standard uncertaint y (µm)
winding of the guide	$u(\delta l_s)$	rectangular	1	0,069
viewing microscope	$u(\delta l_{vm})$	normal type B	1	0,004
thermal coefficient of expansion	$u(\alpha)$ $\alpha = 8{,}302 \cdot 10^{-6}$C^{-1}	rectangular	$L \cdot \Delta t$ $\Delta t = 0{,}03$ °C	0,009L
temperature: -calibration of thermometer - reading error - non uniformity of temperature along the line	$u(t_t)$ $u(t_c)$ $u(t_g)$	normal type B trapezoidal rectangular	αL αL αL	0,208L 0,025 L 0,143L
wavelength correction due to the environmental parameters	$u(\delta\lambda)$	normal type B	1	0,022L
deviation of the flatness of the mirrors of retro-reflectors	$u(\Delta p)$	rectangular	1	0,046
cosines angle	$u(\phi)$	rectangular	1	0,002L
time of data acquisition	$u(v)$	rectangular	1	0,007
electronic block	$u(e)$	rectangular	1	0

d) For the delay error for data acquisition due to inertia and the swinging of the system around the measurement point, in case the retro-reflector displaces during the time when the measurement takes place with a time equal to 25 ns. We can estimate that the analyses of the measurements can be made in a time equal to 1/20 of the time necessary to make the measurement, and the error depends on the velocity of the retro-reflector. If we suppose a maximum velocity of about 10 mm/m, the error is given by the formula:

$$E_{\text{achiz}} = v_{\text{retroreflector}} \cdot \Delta t \, / \, 20 = 0.012 \text{ µm} \quad (8)$$

e) Error due to the electronic block, according to the signal filter and the fringe counter

The system resolution is 0.3 nm, and the counter accuracy can be situated between 1.3 … 1.5 increments. By multiplying both values, the error can be estimated at about 0.45 nm.

3 Uncertainty budget

According to the errors which appear in the measurement of the line standards using the longitudinal comparator for line standards, the following uncertainty budget results (see Table 2):

$$u_c = \sqrt{(0.083)^2 + (0.255L)^2} \text{ µm} \quad (9)$$

For $k = 2$, the expanded uncertainty has a value equal to: $U = [0{,}17 + 0{,}51\ L]$ µm, where L is the nominal length in meters.

Conclusions

With the acquisition of the microscope made by Hirox Japan, together with a CCD camera having a resolution of 1280 × 1024 pixels, custom software for image capture and the replacement of the optical microscope which previously equipped the interferential comparator, an improvement in the expanded uncertainty was obtained from $U = [1 + 5\ L]$ µm to $U = [0.17 + 0.51\ L]$ µm, where L is the nominal length in meters.

Analyzing the uncertainty components to obtain better results, it transpires that it could be necessary to acquire thermometers having a resolution equal to 0.001 °C and an expanded uncertainty equal to 0.005 °C, which could contribute to a decrease in the influence of temperature-dependent factors.

But even under these conditions and applying the method of calibration using an interferential comparator, we can obtain high accuracy measurements for line standards with marks, which demonstrate the Romanian Length Laboratory's capability to carry out this kind of measurements. ■

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OIML SEMINAR: LEGAL METROLOGY ASPECTS OF PREPACKAGING FOR INTERNATIONAL TRADE

The economic importance of legal metrology in pre-packaging

JOHN BIRCH AM,
CIML Honorary Member

1 Summary

This paper summarises work on quantifying the economic and social benefits of metrology and extends the analysis to domestic and global trade in pre-packaged goods. The economic impact of Mutual Acceptance Arrangements (MAA) is analysed and the opportunities and difficulties facing developing countries in accessing global trade in pre-packaged goods are also considered.

2 Introduction

The control of prepacked goods by trade measurement authorities has traditionally been by inspection in the market place. The introduction by the European Community of e-marking of pre-packages has greatly facilitated trade in these products in the European Community but has introduced some technical barriers to trade in pre-packaged goods into Europe.

Ten years ago, Australian wine exporters began to experience difficulties in having their wine shipments cleared through Customs in the United Kingdom. EU requirements for quantity labelling on the bottles were for the Australian Weights and Measures authorities to certify the packer's system of metrological control using either sampling, check weighers or measurement container bottles. At the time the Australian Weights and Measures authorities were controlling packing at point of sale rather than at the packer's premises.

The initial response was to establish systems in Australia to gain acceptance for e-mark labelling, however when similar difficulties were experienced with wine exports to Japan it was proposed to the CIML that requirements for a global mark for the quantity labelling of pre packed goods be introduced and be covered by a voluntary Mutual Acceptance Arrangement.

At that time the OIML had begun the development of the MAA for the approval of measuring instruments, and it seemed at the time that the global trade in prepacked goods was also quite significant economically, and that an MAA for pre-packaged quantity statements would provide considerable reduction in technical barriers to trade.

In 2003 the author completed a study for the CIML on the *Benefits of Legal Metrology to the Economy and Society* (1). The study reviewed over 150 papers and reports on the economic and social benefits of metrology both in national systems, international trade and industry sectors, The principal focus of the study became the identification of methodologies for quantifying the economic benefits of legal metrology.

Both lack of time and available data limited the final results that were obtained from this study. It was recommended that further studies that could be pursued including:

- More detailed information on the value of goods measured in trade measurement transactions, particularly in emerging and developing economies.
- A more detailed study on trade measurement in global trade in commodities. This would be of particular importance to developing countries.
- A study on the benefits of the OIML MAA for pattern approval certification and pre-packaged goods. A first step in such a study would be obtaining an estimate of the level of global trade in these products.

The preparation of this paper provided an opportunity to address some of these issues.

BIML note:

This paper, which expresses the views of the author, was written prior to the OIML TC 6 meeting in Cape Town on 10-11 October 2006, where discussions resulted in a reorientation of the work, which was not foreseeable when this article was written. In view of the complexity of the subject, it was decided during the TC 6 meeting that the OIML would proceed step by step, starting with a voluntary OIML system of quantity marking on pre-packages, managed in each Member State by the CIML Member, and which, at this stage, would not carry any commitment for mutual acceptance. Further issues for mutual acceptance would be addressed in a second step. TC 6 did not have the occasion to review this paper before its meeting. Hence, Mr. Birch's comments will be taken into consideration during the future development of this subject.

3 Economic importance of metrology systems

Over the past forty years there have been a number of studies that attempted to quantify the economic importance of metrology systems.

Beginning in the 1960's NBS (now NIST) conducted a number of studies on the economic impact of the national measurement system. A 1972 summary report of these studies (2) found that the cost of measurement activities in the US measurement system was 6 % of GNP, of which 85 % was labour.

In 1984 Don Vito at NBS (3) estimated the cost of measurement and the value added (defined as the value of goods and services sold less non-labour costs plus certain other items such as profits and indirect business taxes) as 3.5 % of GNP.

The total cost of measurement to industry (capital plus labour expenditures), represented approximately two per cent of sales. Approximately three quarters of the cost of measurement was attributable to labour expenditure.

Whilst there had been many studies of the national measurement system, there have been few studies of the trade measurement system. Poulson (4) noted that many of the studies of the NMS had been from the perspective of the physical scientist and suggested that:

> "An alternative approach would be from the perspective of the user and in particular the consumer"

> and noted that "measurement problems for the consumer probably encompass most types of physical measurement."

4 Value of trade measurement transactions

Studies to quantify the economic importance of trade metrology have focussed on the annual value of transactions made by the use of controlled trade measurement instruments.

Surveys conducted by Measurement Canada inspectors in the 1980's (5) resulted in the development of a database on the number and location of all classes of trade weighing and measuring instruments and the mean annual value of commodities and services (e.g. freight charges) traded over each class of instrument.

The data obtained in 1989-1990 from 159,000 of the 300,000 instruments in service indicated that the total value of goods traded over all classes of trade weighing and measuring instruments totalled CAD 203 billion in 1989/90 or 32 % of GNP. This did not include pre-packaged goods or utility metering. It was also found that on average total trade measurement inequity was comprised of 65 % short measure and 35 % over measure.

In Australia the National Standards Commission in 1994 (6) reported on estimates from Australian National accounts data of the value of trade.

In the USA an estimate was made by Tina Butcher at NIST (7) of the total value of weights and measures transactions in the USA in 1996 using government and industry data. It was found that weights and measures regulations impact on transactions involving USD 4.13 trillion which was 54.5 % of the USD 7.57 trillion US GDP (1996).

The large aggregate value of these transactions results from the multiple measurements that are made for transactions, freight and government taxes as the commodities move from point of production to point of consumption.

A number of studies have limited their scope to the economic value of the consumer protection role of weights and measures systems.

LACOTS estimated (8) in 2000 that goods to the value of more than EUR 3 billion are measured every day by businesses in the EEA using equipment that is regularly inspected, i.e. about EUR 1 trillion annually or 12 % of GNP. However, this figure related only to the consumer protection role of trade measurement, which is only about 25 % of the total value of trade measurements.

In the UK the Department of Trade and Industry (DTI) estimated in 2002 (9) that the annual value of goods sold to consumers by measure, excluding utility measurements, was GBP 120 billion or 15 % of GDP.

5 Benefits of trade metrology to the economy

Whilst the trade metrology system plays a significant role in consumer protection and facilitating trade, its benefits to industry, commence, government and society are much broader than indicated by the previous analysis and include:

1 Reduced dispute and transaction costs
2 Level playing field for commerce
3 Effective stock control
4 Control of fraud

(all of which increase business efficiency)

5 Full collection of government excise and taxes based on measurement
6 Full national benefit for commodity exports
7 Support of global trade

Sector	Commercial	Retail	Export	Taxes	Freight
Agriculture	20,474		5,599		
Mining	28,886		14,639		
Manufacturing					
Food, Beverages	34,974	47.487	7,891		
Chemicals, Petroleum	23,485	17,201	3,012	9,433	
Basic metals	21,446		11,281	1,197	
Paper products	14,793		373		
Wood products	7,829		556		
Non metallic products		751	221		
Textiles	4,049		2,279		
Reticulated services					
Electricity	8,121	16,747			
Gas	1,526	2,788			
Water		586			
Freight					
Road					5,187
Rail					2,583
Total	173,099	84,804	45,851	10,530	7,770
% of total	54	26	14	3	2

Fig. 1 Value of trade measurement transactions in the Australian economy (AUD millions) 1990-91

Total value of trade measurement transactions: AUD 322,000 million

Note: The value of retail transactions was only 26 % of the total measurement transactions in the Australian economy. The total value of trade measurement transactions was estimated to be approx. 60 % of the GNP which, as it included pre-packaged goods and utility metering, was consistent with the figure found by Measurement Canada.

6 Pre-packaged goods

Pre-packaged goods cover a wide range of commodities, and consolidated figures for domestic and international trade have been difficult to obtain. In addition, trade in high value food products is expanding enormously, fuelled by changing consumer tastes and advances in production, transport and other supply-chain technologies. As an example, sales of pre-packed meat have risen from 23 % of market share in Germany in 2000 to 43 % in 2005 (10).

The DTI (UK) study mentioned above (9) estimated retail food sales in the UK of GBP 60 billion, of which about two thirds were prepacked, and a similar amount was spent on non-food pre-packaged goods, with the total sales of pre-packaged goods amounting to 10 % of GDP. This study also estimated short measure on these pre-packaged sales at GBP 200 million.

Similar figures were found in a European Commission document in 2005 (11), which stated that:

> "Turnover of retail trade of foodstuffs is around EUR 600 billion. Assuming that two thirds are sold in pre-packages, turnover would amount to EUR 400 billion or 4 % of GDP of the European Union. To this should be added the turnover of non-food stuffs sold in pre packages, which may amount to a figure of similar order. In total, turnover in pre-packages could amount to 6-10 % of GNP."

In the Asia Pacific Region, retail food sales in 2005 were estimated (12) at USD 1.8 trillion or approximately 8 % of GDP. It was also estimated that 75 % of all retail food is sold through modern supermarkets.

In Australia (13) packaged food and grocery products in 2000 had a turnover of AUD 54 billion or 9 % of GDP and the value of processed food exports in 2000 was AUD 20 billion or 3.5 % of GDP.

Global trade of merchandise in 2000 was USD 6 trillion of which 10 % was food and 75 % of which was processed, i.e. global trade in pre-packed food was USD 450 billion and possibly a similar amount for pre-packed non-food products including alcohol, giving a total global trade in pre-packed goods of USD 900 billion or 15 % of global merchandise trade. With global GDP in 2000 of USD 30 trillion, global trade in prepacked goods by measure is estimated at 3 % of global GDP.

Internationally, the processed food and beverage trade is increasing twice as fast as the trade in primary commodities and accounted for 75 % of global agri-food trade in 2002 (16).

Sale of beer and wine is another significant area of pre-packaged goods, with world beer sales in excess of USD 350 billion (14) and Wine sales (15) of USD 100 billion, including export sales of over USD 25 billion.

As in domestic trade, the figure of USD 900 billion would be subject to multiplication factors due to transactions between manufacturers, exporters, importers, wholesalers, retailers and consumers as well as freight and government taxes. As a result the annual value of transactions for pre-packed goods in global trade could be as high as USD 3,000 billion.

In this regard Christopher B. Guay, Regulatory Fellow in North America for Proctor and Gamble has stated (17):

> "The integrity of measurement in international goods is just as great as for domestic goods. In fact it might be a little greater. As a manufacturer, we want a level playing field on which to compete. Therefore we want an imported product to have to meet the same requirements in a country as a domestic manufacturer in that same country. Being made outside that country shouldn't cause a product to be held to a different standard nor prevent local officials from taking action as appropriate. The problem with an imported product is there may be no domestic means of assuring product at manufacture is compliant."

7 Economic impact of mutual acceptance arrangements

The Doha Development Round was an attempt to rebalance trade rules in favour of developing countries while boosting the world economy. The OECD has estimated at nearly USD 100 billion the gains that could be achieved from full tariff liberalisation for industrial and agricultural goods (18) and the gains from liberalisation of technical barriers to trade (TBT) could be greater. The failure of these negotiations gives added impetus for mutual acceptance arrangements for measured quantities. In this regard it should be noted that the major reason for TBT notifications concerning agro-food products is prevention of deceptive practises and consumer protection (19).

7.1 OIML MAA on measuring instruments

The Mutual Acceptance Arrangement for pattern approval testing, currently being developed by the OIML will have a significant economic impact by eliminating multiple testing of instruments, facilitating global trade in these instruments and supporting the early entry of new instruments to the market place. Quantifying the benefits of this agreement requires information on the current degree of multiple testing, the fees and other costs associated with the testing and the value of trade measurement instruments sold annually. This information is currently not available.

In addition, as mentioned above the annual value of goods measured across approved trade measuring instruments is approximately 50 % of GDP, and confidence provided in these measurements by the trade metrology system would be enhanced by an MAA on measuring instruments, particularly in developing countries that lack the approval testing infrastructure.

Sales of measurement and testing equipment in the EU in 1999/2000 were EUR 48 billion (8) of which about EUR 10 billion could be approved trade and legal measuring instruments. It is estimated from these figures that world-wide sales of trade and legal measuring instruments could be about EUR 30 billion of which possibly EUR 10 billion is traded globally. However, only a small percentage of this figure is currently covered by the OIML MAA.

7.2 CIPM MRA

In 2002, KPMG conducted a study for the CIPM (20) of the potential economic impact of the CIPM Mutual Recognition Arrangement (MRA). It considered the economic impact in terms of:

The gains in cost efficiency for National Metrology Institutions (NMIs) in establishing mutual recognition multilaterally through central co- ordination rather than bilaterally.

Economic efficiency resulting from reductions in technical barriers to trade (TBT).

Based on information provided by a survey of NMIs it was estimated that there was a notional saving to each participating NMI of EUR 75,000 per annum in the cost of establishing and maintaining mutual recognition, and the total notional saving to the community of NMIs was of the order of EUR 85 million.

The study noted that a measure of the extent to which the TBT might be limiting or raising the costs of trade has yet to be estimated by the WTO, OECD, the World Bank or other parties. However, studies have indicated that the reduction of non-tariff barriers to trade can be expected to result in as much as 10 % net benefit. Based on the value of the trade between nations participating in the MRA as over USD 4 trillion, it was noted that a one-tenth per cent increase in trade values would translate into an increase in value of over USD 4 billion, amongst the 28 nations that are considered, and this was viewed by the study as a conservative estimate of the benefit.

However, no estimate appears to have been made by the study of the correction factors that should be made for the percentage of trade affected by technical barriers to trade and the extent to which the technical barriers to trade are measurement-related. These factors could markedly reduce the benefit.

7.3 OIML MAA for pre-packaged goods

The OIML is also considering developing an MAA for pre-packaged goods. This is a sector were there are significant technical barriers to trade and the value of transactions in the global trade of these goods could be as high as USD 3,000 billion (see above).

An MAA for pre-packaged goods would reduce multiple testing of products, speed up entry of goods across borders, provide a level playing field for global commerce, reduce compliance costs, enhance consumer protection and reduce fraud. In addition, as indicated by the KPMG study, international MAAs are far more cost effective than multiple bilateral or regional arrangements. It is difficult to estimate the economic impact of such an MAA, but the benefit should be at least equal to the KPMG estimate of 0.1 % and the DTI (UK) estimate of 0.25 %, i.e. between USD 1 billion and USD 6 billion.

8 Developing countries

The UNCTAD specialist workshop on commodity exports of LDCs held in 2002 (21) recognised the importance of a measurement infrastructure for developing countries. The Chairperson's summary report included the following recommendation:

> "25. An adequate measurement system (both in quantitative and qualitative terms) has been often overlooked although it is essential in accurate valuation of goods. It also reduces transaction costs and disputes, improves collection of government revenue, controls fraud and improves export earnings. Experts supported the development of an international system and urged international organisations to contribute to its mainstreaming."

However, the emphasis at this meeting was primarily on export of bulk commodities and little consideration was given to pre-packaged goods. As mentioned above the global trade in processed food and beverage trade is increasing twice as fast as trade in primary commodities, and was expected to account for 75 % of global agri-food trade in 2000.

Developing countries are also benefiting from the increased trade in high value food products with fresh and processed fruit and vegetables, fish, meat, nuts, and spices now accounting for more than 50 % of the agri-food exports of developing countries. Their share of developing country trade continues to rise while that of traditional commodities such as coffee, tea, cocoa, sugar, cotton and tobacco decline.

Developing countries should also benefit from increased demand for tropical fruits and vegetables, spices and nuts and for organic food. Pre-packing such products can markedly increase their value.

Supermarket sales in the Asia Pacific region have grown most in the developing economies (12). The first supermarket opened in China in 1990 and today supermarkets account for 30 % of retail food sales in China's urban areas. Supermarkets accounted for 11 % of national retail food sales in 2002 compared with less than 1 % a decade ago.

Indonesia is also experiencing rapid growth in packaged and processed food with supermarket sales reaching 30 % of retail sales in 2004.

A survey (22) conducted by the Asia Pacific Legal Metrology Forum (APLMF) of its members' legislation for pre-packaged goods identified training on the implementation of OIML R 87 as a major priority and as a result the APLMF has organised two training courses on pre-packed goods for developing country members.

Similarly, a recent study on the development of a regional metrology system for the fourteen island states of the Pacific Island Forum identified pre-packed goods as a major concern both for domestic and international trade (23).

However, difficulties and costs of complying with more stringent and diverse requirements tend to marginalize weaker economic players, including smaller countries, enterprises and farmers. An OIML MAA on pre-packaged goods could assist developing countries to overcome some of these difficulties.

9 Conclusion

Pre-packaging and international trade have been two relatively neglected areas of OIML activities in proportion to their economic importance. In many countries, enforcement of pre-packaging is not the responsibility of the trade measurement authority and national measurement legislation is often limited to domestic trade, with limited jurisdiction over international trade transactions. However, the increasing economic importance of pre-packed goods in international trade requires the OIML to give greater prominence to introducing systems to facilitate trade in this areas of legal metrology. ■

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CAPE TOWN

41st CIML Meeting and Associated Events

Cape Town, South Africa

11–20 October 2006

The South African Bureau of Standards (SABS) hosted the following Meetings in the Arabella Sheraton Grand Hotel, Cape Town, from 11 through 20 October 2006:

- *41st CIML Meeting,*
- *OIML TC 6 "Prepackaged products",*
- *Seminar on Prepackaging,*
- *OIML Working Group on Conformity to Type,*
- *Permanent Working Group on Developing Countries (PWGDC), and*
- *SADCMEL.*

CAPE TOWN

41st CIML Meeting: Opening Address

Mr. Martin Kuscus
CEO, SABS, South Africa

Mr. President of the CIML Alan Johnston,
Officials of the OIML,
Delegates to the CIML,
Distinguished Guests,
Ladies and Gentlemen,

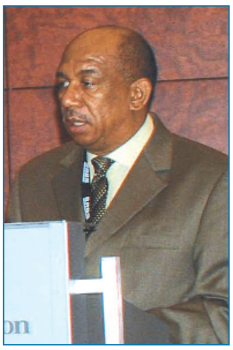
I bring with me greetings from the Council of the South African Bureau of Standards, the host of this CIML Meeting, and would like to take the opportunity to welcome you all.

Now, I did not write the rules of geography, but it is an established fact that the world is divided into seven regions: North America, South America, Europe, Africa, Asia, Australia, and then... South Africa - the *World in one place*! And I trust that as you go about your work, you will experience the *World in one place* and that you will have time to savor the sights and the very interesting history that Cape Town has to offer.

Traditionally in the long history of Africa, the indigenous population traded by means of the barter system. In South Africa, formal legal metrology control can be traced back to the settlement of the Dutch at the Cape of Good Hope in the late 1600's.

The weights and measures system broke down to a large extent when the Dutch farmers trekked north to escape the English occupation.

And in the late 1800's there were weights and measures offices in the major towns such as Cape Town, Johannesburg, Durban, Pretoria, and Bloemfontein.



The rural areas were not serviced however, and the first government of the Union of South Africa, through the Department of Mines, decided that the matter needed urgent attention.

In 1920, the first national legislation on legal metrology was promulgated. Later on, this Act was replaced by the Weights and Measures Act in 1958, and then by the Trade Metrology Act in 1977, which is the current legislation which governs our country.

I do not want to harp on the vicissitudes of the past; our unfortunate past has been a matter of international concern which actually led to the exclusion of South Africa from participation in a lot of international forums. Through this period, legal metrology had to keep abreast in many areas through OIML publications, but there was no direct participation where our voice could be heard and where we could engage with our counterparts in a really meaningful way.

But during the advent of our democratic dispensation in 1994, when a new government came into power and South Africa entered the global stage, we wasted no time in applying for membership of the OIML and we were greatly encouraged and assisted by members of the BIML at that time.

South Africa become a member of the OIML in 1998 and has keenly participated in meetings and in several Technical Committees since then.

Our country has taken off in many ways, not only on the socio-political front, but also on the economic front and in many respects we became world leaders in certain industries which warranted enhancement of our metrology infrastructure – in fact not only metrology but our whole quality infrastructure.

In 1999, the Department of Trade and Industry undertook a review of Standards, Quality assurance, Accreditation and Metrology (commonly known as the SQAM review). This review looked at the whole technical infrastructure in South Africa, and in 2001 the results of this review group's recommendations were published.

This led to very fundamental changes in the SQAM environment, and there is now a whole series of legislative reviews including the promulgation of a new Standards Act, the Regulatory and Compulsory Standards Act, the Accreditation Act and the Measurements Act. As I am talking to you now, just last week, in our parliament a new legal metrology infrastructure was debated around this Measurements Act, and we hope that by the middle of next year, this whole process will be finalized.

We cannot underscore the importance of legal metrology in our country, and the work done by yourselves as the OIML has greatly shaped our thinking and greatly influenced our approach in moving our country forward.

I am aware of how important legal metrology is to the economy - not only for our country but for our Region as a whole, as we are now pursuing in Southern Africa what we call SADC (the Southern African Development Community), a free trade block, which our political masters would like to be implemented in 2011.

This needs to be supported by a very strong standards, quality assurance, accreditation and metrology infrastructure. Therefore, I have been informed of the importance of the activities that have taken place since your arrival here, and how the deliberations in the various meetings (as well as those to be made during this prestigious gathering over the next three days) have produced and will continue to contribute to the aims and objectives of the Organization. I wish you every success in your deliberations and it is with great pride and humility that we host the 41st CIML Meeting.

Without any further due, I would like to declare the CIML Meeting open, and trust that you enjoy your stay in our beautiful country, South Africa.

Lastly, for those of you who do not already know, we will be hosting the 2010 World Cup! So you may start booking your accommodation, and make sure that you start surveying the scene here, so that you return with as many of your friends as possible, to our wonderful shores.

Thank you, and may I wish you a very successful meeting. ■

CAPE TOWN

41st CIML Meeting: Opening Address

Mr. Alan E. Johnston
CIML President

Good morning Ladies and Gentlemen,

Welcome to Cape Town. First of all Martin Kuscus many thanks for your very gracious welcome and also for your geography lesson which I appreciated!

I would first like to thank the South African Government and the South African Bureau of Standards for hosting this CIML Meeting in Cape Town. South Africa is one of our most active and dynamic Members within the OIML thanks to Stuart Carstens, our Vice President, and also to all his staff within SABS.

South Africa is also the leading country in this Region and contributes to the success of the Regional Metrology Cooperation, SADCMEL, whose Members have demonstrated a great interest in legal metrology developments. And, last but not least of course, I have to mention that SABS has done an excellent job in organizing this CIML Meeting in this beautiful city of Cape Town, taking care of the meeting facilities and organizing the accommodation of delegates. Thanks to Stuart and also a special thank to Ronèl Pretorius for these arrangements.

It is my pleasure to welcome you all here today to the 41st Meeting of our Committee where we have more than 120 delegates, Observers and Liaison Organizations.

Since the last CIML Meeting, a number of countries have expressed an interest in becoming an OIML Member State or a Corresponding Member, and we can expect our membership to grow in the near future. The following changes have occurred in the OIML membership:

- the Democratic People's Republic of Korea has asked to change from Member State to Corresponding Member; and
- Zambia was admitted as a Corresponding Member.

We therefore now have 59 Member States and 54 Corresponding Members.

In reviewing the composition of our Committee, I have the pleasure of welcoming some new CIML Members:

- Dr. Katerin Katerinov from Bulgaria,
- Mr. Mirko Vukovic from Croatia,
- Prof. Roman Schwartz from Germany,

- Mr. Mukhambetov from Kazakhstan,
- Mr. Nabil Bin Amin Molla from Saudi Arabia,
- Mr. Mohamed Laouini from Tunisia, and
- Dr. Atilla Sahin from Turkey.

I have also the pleasure of welcoming representatives from the Liaison Organizations:

- Mrs. Vivien Liu from the World Trade Organization,
- Mr. Andrew Wallard from the Bureau International des Poids et Mesures,
- Mr. Mike Peet from ILAC,
- Dr. C.J. Johnston from the IEC, and
- Mr. Martin Stoll from CECIP.

I am also pleased to have amongst us today:

- Gerard Faber, CIML Past President, and
- John Birch, Honorary CIML Member.

Coming now to a short review of the last year since the 40th Committee Meeting in Lyon, I would like to highlight a number of key issues:

- Cooperation between the OIML, the BIPM and ILAC has made some concrete progress; further information will be presented to you later in the Meeting,
- A new Long Term Strategy paper will be submitted for your approval,
- The implementation of the MAA has resulted in the signing of two Declarations of Mutual Confidence,
- Technical work has progressed well and a number of new and revised publications will be submitted for your approval,
- We will elect a Second CIML Vice-President, and
- The appointment of a new Assistant Director will be submitted for your approval.

An interesting Seminar was held this Monday, concentrating on an issue of considerable importance to the Member States and for international trade: prepackaging. Stuart Carstens will provide you with a report of this Seminar during the CIML Meeting.

There is one issue which I would like to bring to your attention today. In recent years we have asked Jean-François Magana and his staff at the BIML to find ways to accelerate the technical work and the approval of OIML publications. A number of improvements have been made by the Bureau, in particular the use of the OIML web site. For example, we have had the ability to vote online for over a year. Unfortunately, the results of online voting have been disappointing, and in most cases only about 50 % of the CIML Members did vote online. For this reason, the approval of a number of projects had to be postponed to this CIML Meeting, which represented a delay of between six months to one year to obtain the required approval.

As you know, the success of the OIML depends on your participation and on your commitment and we cannot fulfil our goals if Members do not actively respond. In the near future, technical work will be conducted via the OIML web site and this activity will require your active involvement in these web-based activities so I urge you to vote in a timely manner on all projects that are submitted to you via the OIML web site, and also to ask your experts to actively participate via the site, which will be put at their disposal for technical work. This is necessary to answer the needs of all legal metrology stakeholders in all of our countries.

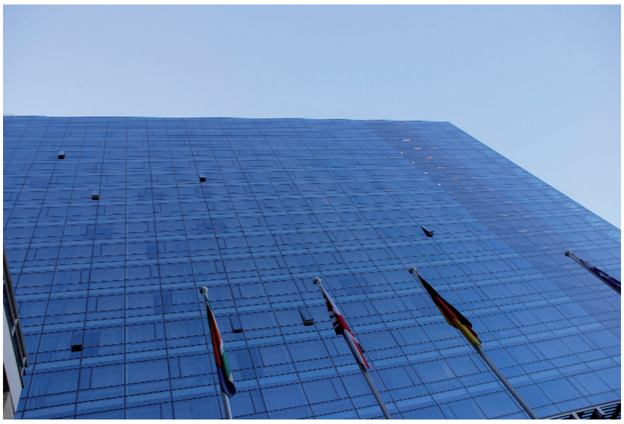
I would welcome any ideas from you as to how we can improve our ability to work and vote online; for example, would more reminders from the BIML be beneficial? Is more training required on how to effectively use the web site? Please bring any ideas forward to my attention, or feel free to contact any of the BIML staff.

In conclusion, we have a very busy and interesting agenda for the three-day CIML Meeting and I look forward to your assistance and cooperation to ensure its success.

Thank you very much for your time. ■

CAPE TOWN

41st CIML Meeting: Agenda



Opening address
Roll-call - Quorum
Approval of the agenda

1 Approval of the minutes of the 40th CIML Meeting

2 Member States and Corresponding Members
2.1 Situation of certain Members

3 Financial matters
3.1 Adoption of the Auditor's report for 2005
3.2 Assets and liabilities as at 01/01/2005 and at 01/01/2006
3.3 Financial report for 2005 and estimates for 2006
3.4 Progress on the Pension Scheme

4 Presidential Council activities
4.1 Report on Presidential Council activities
4.2 Long Term Strategy and Action Plan
4a *(New Item)* Report on the Packaging Seminar

5 Developing Country activities
5.1 Report on PWGDC activities
5.2 Report on JCDCMAS activities

6 Liaisons
6.1 Presentation by the Bureau on liaison activities
6.2 Updates by Liaison Organizations
6.3 Updates by RLMOs

7 BIML activities
7.1 Organization of the Bureau
7.2 Communication, web site
7.3 Report on BIML activities for 2005-2006

8 Technical activities
8.1 Approval of International Recommendations and Documents
8.2 Examination of the situation of certain TCs/SCs
8.2a *(New Item)* OIML Certificate System
8.3 MAA
8.4 Progress on the revision of the Directives
8.5 *(New Item)* Report on the Working Group on "Conformity to Type"

9 Human resource matters
9.1 Approval of the Procedure for the election of the CIML President and Vice-Presidents
9.2 Election of the CIML Second Vice-President
9.3 Appointment of a new Assistant Director
9.4 Dispute related to the dismissal of a BIML Secretary

10 Future meetings
10.1 42nd CIML Meeting (2007)
10.2 13th Conference and 43rd CIML Meeting (2008)

11 Awards

12 Other matters

The 41st CIML Meeting was attended by over 120 delegates, pictured here in session (Arabella Sheraton Hotel conference room)

The magnificent view from the top of Table Mountain, altitude 1085 m above sea level

Photos: Samuel Just, BIML

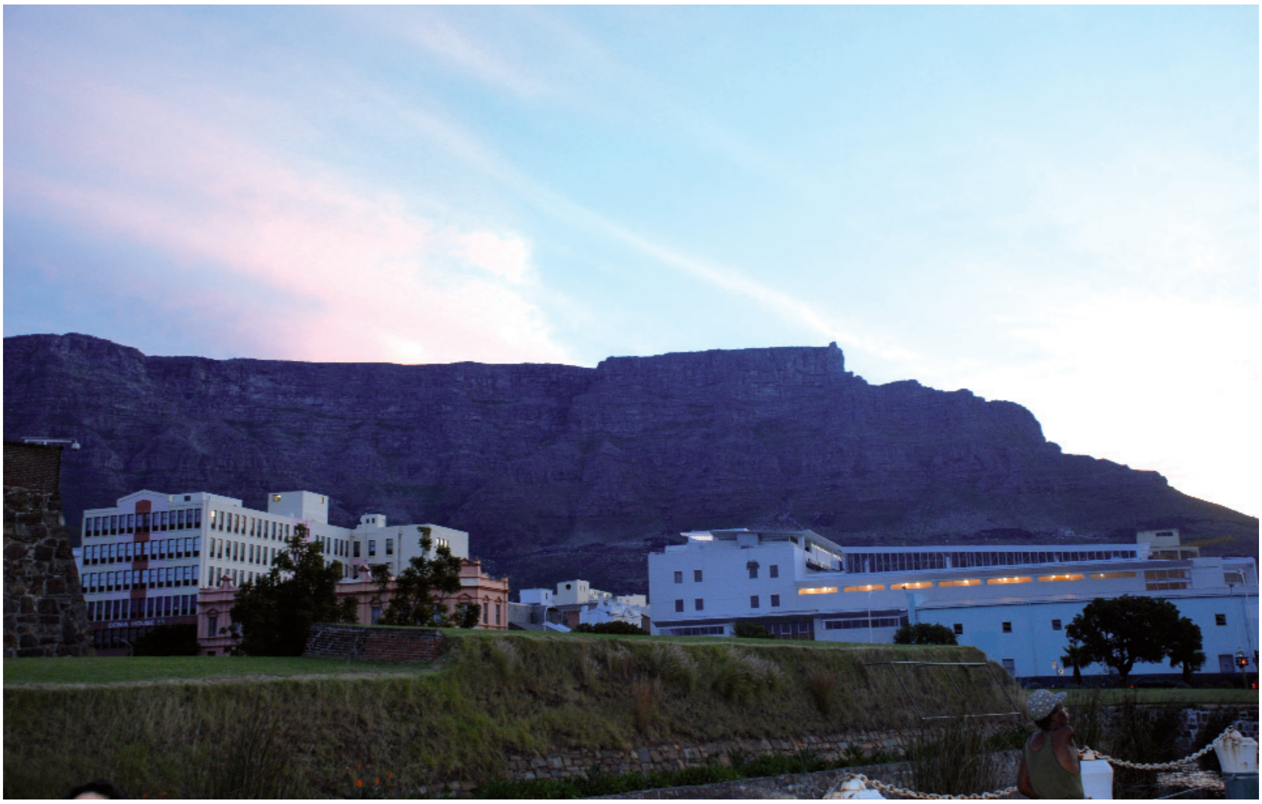
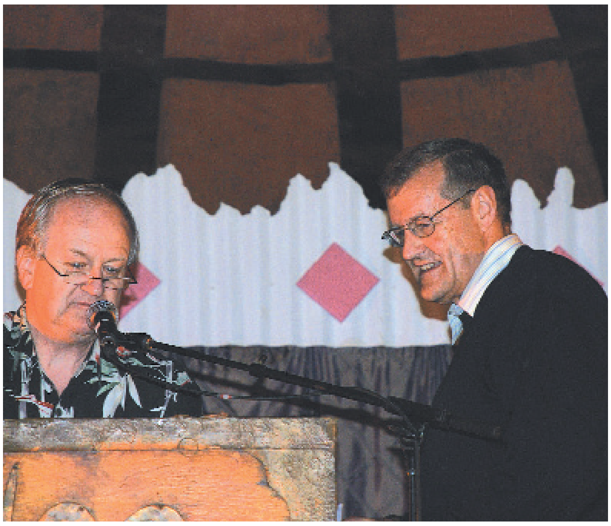
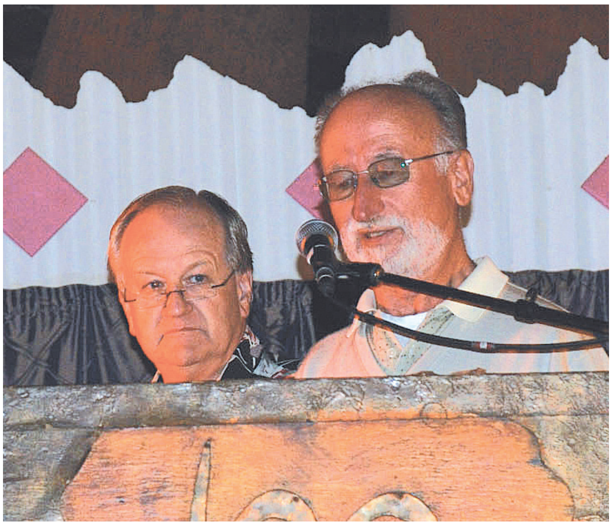


Table Mountain at dusk,
as seen from Cape Town City Center

The tranquil surroundings at the Moyo Restaurant,
where the OIML Reception was hosted





Four OIML Medals were awarded:
Top left: Manfred Kochsiek; Top right: Eberhard Seiler
Bottom left: Martin Birdseye; Bottom right: Attila Szilvássy.

A Letter of Appreciation was also given to Mrs Corinne Lagauterie (below)

Musicians welcomed us at the entrance to the Castle of Good Hope, where SABS hosted an extremely enjoyable and lively dinner

Traditional African dancers accompanied the dinner at Moyo, on the occasion of the OIML Reception

FORTY-FIRST MEETING
of the
INTERNATIONAL COMMITTEE of LEGAL METROLOGY
Cape Town, 18–20 October 2006

DECISIONS

Opening addresses

The Committee took note of Opening Addresses delivered by Mr. Martin Kuscus (CEO, SABS, South Africa), and by Mr. Alan E. Johnston (CIML President, Canada).

Roll Call - Quorum

52 Member States out of 59 were present or represented at the opening of the 41st CIML Meeting. The quorum (45 Member States) was therefore reached.

The Committee also noted the participation of a number of OIML Corresponding Members, Observer Countries, Liaison Institutions and Regional Legal Metrology Organizations, as well as the CIML Immediate Past President, one CIML Honorary Member, and members of SABS and BIML Staff.

Approval of the Agenda

The Draft Agenda (Version 2 dated 11 July 2006) was approved with the following modifications:

- New item 4a "Report on the Packaging Seminar";
- New item 8.2a "OIML Certificate System";
- New item 8.5 Report of the Working Group on "Conformity to Type"

1 Approval of the Minutes of the 40th CIML Meeting

The Minutes of the 40th CIML Meeting were approved without modification.

2 Member States and Corresponding Members

2.1 Situation of certain Members

The CIML noted the situation of the Democratic People's Republic of Korea and Zambia concerning the payment of their arrears. These two countries had changed their status to become Corresponding Members since the 40th CIML Meeting.

The CIML also noted the report given by the BIML Director on the implementation of the 40th CIML Meeting's decision to review Member States' contributory shares.

3 Financial matters

3.1 Adoption of the Auditor's report for 2005

The Committee approved the Auditor's report for 2005 and requested its President and the BIML Director to submit it to the Thirteenth Conference in 2008.

3.2 Assets and liabilities as at 01/01/2005 and 31/12/2005

The Committee took note of information given by the BIML Director concerning the estimation of the assets and liabilities according to the new accountancy system laid down by the new Financial Regulations.

3.3 Financial report for 2005 and estimates for 2006

The Committee took note of a presentation given by the BIML Director concerning the 2005 financial period and the estimates for 2006. It noted that the 2005 result was better than forecast. In 2006, savings should partially compensate the Pension Fund endowment increase.

The Committee instructed the Bureau to prepare preliminary figures for the 2009-2012 budget taking account of this endowment. These figures would require discussion at the 42nd CIML Meeting in 2007.

3.4 Progress on the Pension Scheme

The Committee took note of a report given by the BIML Director concerning progress made in the study of the OIML Pension Scheme and instructed its President and the BIML Director to continue the study and to compare the OIML Scheme to existing systems in similar organizations, coming back with proposals, if appropriate, at the 42nd CIML Meeting.

4 Presidential Council activities

4.1 Report on Presidential Council activities

The Committee took note of a report from its President concerning the activities of the Presidential Council since the 40th CIML Meeting.

4.2 Long Term Strategy and Action Plan

The Committee approved the Strategy paper and instructed its President to finalize it, taking account of comments received. The Bureau would develop an Action Plan based on it with a view to having it approved at the 42nd CIML Meeting.

4 a (Additional item) Report on the Packaging Seminar

The Committee took note of a report given by Mr. Carstens on the Packaging Seminar held on Monday 16 October 2006. It requested the Bureau to make an inquiry on Member States' regulatory needs for the quantity in prepackages. A subsequent inquiry would concern packers' needs for market access.

5 Developing Country activities

5.1 Report on PWGDC activities

The Committee took note of a report given by Messrs. Seiler and Dunmill on the activities of the Permanent Working Group on Developing Countries (PWGDC) and expressed its appreciation to Mr. Seiler for his efficient chairmanship.

The Committee decided that Mr. Seiler's proposals should be given due consideration and requested that developing country activities be included in the OIML Strategy Paper and also in the Action Plan.

5.2 Report on JCDCMAS activities

The Committee took note of a report given by Mr. Dunmill on the activities of the Joint Committee for the coordination of technical assistance to Developing Countries in Metrology, Accreditation and Standardization (JCDCMAS), the secretariat of which was held by the Bureau in 2005.

6 Liaisons

6.1 Presentation by the Bureau on liaison activities

The Committee took note of a presentation given by the BIML Director concerning liaison activities.

BIPM/Metre Convention

The Committee expressed its appreciation of the draft OIML/Metre Convention joint Action Plan and instructed its President and the BIML Director to continue this cooperation, and to report back at the 42nd CIML Meeting.

It also appreciated the tangible efforts made by the two Organizations during the past year, notably concerning the new joint information publication describing their respective domains of activity, steps to set up a common web portal and the work engaged on joint thematic leaflets resulting from a series of meetings held between Staff of the two Bureaux.

ILAC

The Committee expressed its appreciation of the OIML/ILAC draft Memorandum of Understanding and instructed its President to take account of the comments expressed with a view to signing it as soon as possible.

JCGM

The Committee instructed the Bureau to summarize CIML Members' comments on the Draft revision of the

International Vocabulary of Metrology (VIM) and on the Supplements to the GUM, and to present them to the Joint Committee on Guides on Metrology (JCGM). The Committee empowered the BIML Director to endorse the final revision of the VIM and the Supplements to the GUM at the JCGM Meeting.

6.2 Updates by Liaison Organizations

The Committee took note of information given by the following Liaison Organizations concerning their activities, and thanked their representatives:

- WTO Ms. Liu
- BIPM Mr. Wallard
- ILAC Mr. Peet
- IEC Mr. Johnston
- CECIP Mr. Stoll

6.3 Updates by RLMOs

The Committee took note of information given by Regional Legal Metrology Organizations concerning their activities and thanked their representatives:

- AFRIMETS Mr. Carstens
- APLMF Mr. Ooiwa
- COOMET Mr. Issaev
- SADCMEL Mr. Carstens
- SIM Mr. Ehrlich
- WELMEC Mrs. Lagauterie

7 BIML activities

7.1 Organization of the Bureau and
7.3 Report on BIML activities for 2005–2006

The Committee took note of a presentation given by the BIML Director concerning the organization and activities of the Bureau.

7.2 Communication, web site

The Committee took note of a presentation given by Mr. Pulham concerning developments in this area and expressed its appreciation to the Bureau.

Noting the significant advances made by the BIML in the use of e-communication during the past year, the Committee urged all CIML Members to use the online facilities provided on the OIML web site, and in particular to:

- Post their votes and comments on draft publications within the specified deadlines;
- Encourage the Secretariats of OIML TCs/SCs to regularly check the information published on their respective web pages on the Technical Committees' database; and
- Communicate any information updates to the Bureau as and when available.

The Committee expressed its appreciation that interactive Workgroups for technical work were being made available on the OIML web site and encouraged the Secretariats, P-Members, O-Members and Liaisons of all TCs/SCs to make use of them as soon as available.

It approved the Bureau's proposal that all Committee Drafts be made publicly available on the OIML web site from now on.

8 Technical activities

The Committee took note of a presentation given by Mr. Szilvássy concerning the progress of technical work.

8.1 Approval of International Recommendations and Documents

The Committee approved the following Recommendations:

DR 1: R 49-1	*Water meters intended for the metering of cold potable water and hot water. Part 1: Metrological and technical requirements*;
DR 2: R 49-2	*Water meters intended for the metering of cold potable water and hot water. Part 2: Test methods*;
DR 3: R 137-1	*Gas Meters. Part 1: Requirements* (new Recommendation);
DR 4: R 116	*Inductively coupled plasma atomic emission spectrometers for the measurement of metal pollutants in water*;
DR 5: R 82	*Gas chromatographic systems for the measuring pollution from pesticides and other toxic substances*;
DR 6: R 83	*Gas chromatograph/mass spectrometer systems for the analysis of organic pollutants in water*;
DR 7: R 76-1	*Non-automatic weighing instruments. Part 1: Metrological and technical requirements – Tests*;

DR 8: R 65 *Force measuring system of uniaxial material testing machines*;

DR 9: R 39 *Rockwell hardness machines*;

DR 10: R 51-1 *Automatic catchweighing instruments. Part 1: Metrological and technical requirements – Tests*; and

DR 11: R 134-1 *Automatic instruments for weighing road vehicles in motion and axle-load measuring. Part 1: Metrological and technical requirements – Tests*. The CIML noted that account would be taken of US comments concerning terminology and the overall scope of the Recommendation.

and also approved the following Amendments:

AM 1: Amendment to B 3 *OIML Certificate System for Measuring Instruments*; and

AM 2: Amendment to B 10-1 *Framework for a Mutual Acceptance Arrangement on OIML Type Evaluations (MAA)*.

Considering the importance and highly advanced status of some projects at TC/SC level, the Committee instructed the Bureau to proceed with online CIML approval of the following revised and new Recommendations (once they become available):

- Project of OIML TC 8: *Vessels used for retail sale to the public*;
- Common project of TC 8/SC 3 and SC 4: R 117-1 *Measuring systems for liquids other than water. Part 1: Requirements*;
- Project of OIML TC 8/SC 7: *Measuring systems for gaseous fuel*;
- Project of OIML TC 8/SC 7: *Compressed gaseous fuels measuring systems for vehicles*; and
- Project of OIML TC 17/SC 4: R 56 *Standard solutions reproducing the electrical conductivity*.

The Committee:

- Approved the withdrawal of R 74 *Electronic weighing instruments*; and
- Delegated the decisions on the future of R 24 *Standard one meter bar for verification officers* and R 66 *Length measuring instruments* to its President (in accordance with Article of XV of the Convention). These decisions would be taken after the BIML had conducted a more extensive inquiry among CIML Members following the 41st CIML Meeting.

8.2 Examination of the situation of certain TCs/SCs

The Committee noted that the Secretariats of TC 8/SC 7 *Gas metering* and TC 8/SC 8 *Gas meters*, together with the BIML, would prepare and submit for approval to the CIML at its 42nd meeting the formal proposal to merge these two Subcommittees.

The Committee requested CIML Members to volunteer to assume responsibility for the vacant Secretariat of TC 18/SC 1 *Blood pressure instruments*.

The Committee requested CIML Members to ensure that any CDs which are circulated by those TC/SCs in which their country is a P-member are commented and/or voted on in order to ensure the timely development of projects.

The Committee decided:

- To merge TC 8/SC 3 *Dynamic volume measurement (liquids other than water)* and TC 8/SC 4 *Dynamic mass measurement (liquids other than water)* under the Co-Secretariat of Germany and the USA under the title TC 8/SC 3 *Dynamic volume and mass measurement (liquids other than water)*, and to disband TC 8/SC 4;
- To allocate the Co-Secretariat of TC 5/SC 2 *Software* - hitherto held by France - to the BIML;
- To approve the following work projects:
  - New projects of TC 3/SC 5:
    - Revision of B 3 *OIML Certificate System for Measuring Instruments*;
    - Revision of B 10-1 *Framework for a Mutual Acceptance Arrangement on OIML Type Evaluations* (MAA);
    - Revision of B 10-2 *Checklists for Issuing Authorities and Testing Laboratories carrying out OIML Type Evaluations*;
  - New projects to be allocated by the CIML President to the appropriate TC or SC, based on BIML proposals:
    - *Guide for the application of ISO/IEC Guide 62 to the assessment of quality system certification bodies in the field of legal metrology*;
    - *Guide for the application of ISO 9001 to legal metrology controls*.
  - New project of TC 16/SC 1
    - Revision of ISO 3930/OIML R 99 *Instruments for measuring vehicle exhaust emissions*.

- To withdraw the following work projects:
  - Project p6 of TC 3/SC 5: *OIML procedure for the review of laboratories to enable mutual acceptance of test results and OIML Certificates of Conformity*;
  - Project p2 of TC 17/SC 1 Revision of R 92 *Wood-moisture meters - Verification methods and equipment: general provisions*.

8.2 a OIML Certificate System (new item)

The Committee decided that the following categories of measuring instruments will become applicable within the OIML Certificate System as soon as published:

R 39 *Rockwell hardness machines;*

R 49 *Water meters;*

R 51 *Automatic catchweighing instruments;*

R 65 *Force measuring system of uniaxial material testing machines*;

R 82 *Gas chromatographs for measuring pollution from pesticides and other toxic substances*;

R 83 *Gas chromatograph mass spectrometer/data system for analysis of organic pollutants in water*;

R 75 *Heat meters;*

R 116 *Inductively coupled plasma atomic emission spectrometers for measurement of metal pollutants in water;*

R 136 *Area of leathers.*

The Committee instructed the Secretariats of TC 8/SC 5 and TC 9/SC 2 to draw up documents on *Certificate transformation requirements* for R 49 and R 51 (if necessary).

The Committee approved the proposal made by the Bureau, that:

- When a revision of a publication is published, the previous version remains available on the OIML web site, but with an indication that this version has been superseded;
- As long as the three parts of a revised Recommendation included in the Certificate System have not been published, the version referenced in the Certificate System remains applicable;
- When the Certificate System references a revised Recommendation, Certificates may still be issued by reference to the previous version providing that the application for a Certificate has been lodged before the publication of the revised version.

8.3 MAA

The Committee took note of a presentation given by Mrs. Gaucher on the implementation of the MAA, and expressed its appreciation for the work carried out and on the signature of the two first Declarations of Mutual Confidence (DoMCs).

The Committee approved the following Resolutions:

MAA Resolution 2006-1:

The BIML shall initially bear the costs of peer assessments and subsequently invoice the peer assessed bodies with a lump sum equal to 1500 € per assessor-day.

MAA Resolution 2006-2:

The end of the transitory period during which an OIML Issuing Authority which participates in the R 60 DoMC and/or the R 76 DoMC as a Utilizing Participant or which did not sign the R 60 DoMC and/or the R 76 DoMC will still be authorized to issue OIML Certificates of Conformity according to OIML B 3 outside the scope of the MAA, is provisionally fixed at 31 December 2008.

This deadline will be reviewed by the CIML at its 43rd Meeting based on a BIML report on operation, experience and feedback from industry.

MAA Resolution 2006-3:

The CIML endorsed the decision of its President to launch the R 49 DoMC despite the fact that for the moment there was only one potential Issuing Participant.

In addition to these Resolutions, the Committee took note that Issuing Participants in the R 60 and R 76 DoMCs are able to issue basic OIML Certificates related to applications for OIML type evaluations received before the publication of the DoMC.

The CIML instructed TC 3/SC 5 to consider the rules for appointing new Issuing Authorities after the transition period mentioned in the MAA Resolution 2006-2 above, and to propose an appropriate solution for approval by the Committee

8.4 Progress in the revision of the Directives for Technical Work

The Committee took note of a presentation given by Mr. Dunmill on progress made in the revision of the Directives for Technical Work, and requested the Bureau to endeavor to have the Revision of the Directives ready for approval at the 43rd CIML Meeting in 2008.

8.5 Report of the Working Group on "Conformity to Type"

The Committee took note of the report given by Mr. Harvey, WG Convenor, on the meeting held on 14 October 2006 and instructed the WG to continue its work as proposed during the meeting.

The Committee instructed the Bureau and the TC 3 Secretariat (*Metrological control)* to review the organization of TC 3's work, including that of its Subcommittees and the WG on Conformity to type.

9 Human resource matters

9.1 Approval of the procedure for the election of the CIML President and Vice-Presidents

The Committee approved the procedure for the election of the CIML President and Vice-Presidents and decided that this procedure shall be applicable for the election of the Second Vice-President under Item 9.2 of the Agenda (see below). It instructed the Bureau to publish it on the OIML web site.

9.2 Election of the CIML Second Vice-President

The Committee elected Mr. Harvey (Australia) as CIML Second Vice-President. He will take over his duties immediately.

9.3 Appointment of a new BIML Assistant Director

On the proposal of the CIML President, the Committee appointed Mr. Willem Kool as BIML Assistant Director. This position had become vacant due to the retirement of Mr. Szilvássy in 2007.

9.4 Dispute related to the dismissal of a BIML Secretary

The Committee took note of a report given by the BIML Director concerning an industrial tribunal dispute over the dismissal of a BIML Secretary.

10 Future meetings

10.1 42nd CIML Meeting (2007)

The Committee took note of a presentation given by the People's Republic of China about the organization of the 42nd CIML Meeting in Shanghai in October 2007 and thanked the Chinese Government and the Chinese CIML Member for their invitation, which was confirmed as accepted by the Committee.

10.2 43rd CIML Meeting and 13th Conference (2008)

The Committee accepted Australia's invitation to hold the 13th Conference and 43rd CIML Meeting in Sydney, Australia, in 2008.

11 Awards

The CIML President, in recognition of their outstanding contribution to legal metrology, awarded OIML Medals to the following individuals:

- Prof. Dr. Manfred Kochsiek;
- Mr. Martin Birdseye;
- Mr. Eberhard Seiler;
- Mr. Attila Szilvássy.

The Committee decided to nominate Prof. Dr. Manfred Kochsiek Honorary Member of the CIML and thanked him for his years of service to the Organization.

The CIML President also gave a Letter of Appreciation to Mrs. Corinne Lagauterie for her valuable contribution to drawing up and implementing various OIML Recommendations.

12 Other matters

The CIML took note of a presentation given by Dr. Sahin (Turkey) giving information on the organization of a Seminar on the implications of the MID to be held in Istanbul in 2007. ■

Seminar: Legal Metrology Aspects of Pre Packaging for International Trade

Report by Stuart Carstens, SABS

The Seminar on Pre-packaging, which took place on Monday 16 October in conjunction with the 41st CIML Meeting in Cape Town, was attended by 153 delegates, of whom 57 were from South African Industry covering areas such as the wine industry, food manufacturers and retailers.

Papers were presented by a number of stakeholders, including regulators, from various countries. Perspectives from industry, from associations (for instance the Worldwide Trade Group, a wine industry association), and also from a number of experts were presented, all of which gave a wide diversity of points of view and stimulated discussions.

The economic importance of pre-packages was once again highlighted, and participants noted the need to harmonize the various national regulations in existence and for the mutual acceptance of pre-package certification.

The issue of labeling was still a major barrier to trade, and was a subject that was brought up regularly. OIML R 79 *Labeling requirements for prepackaged products* should be revised with a view to eliminating this problem, preferably in close cooperation with other international organizations such as CODEX and the OIV.

Work would begin on an OIML quantity mark for pre-packages and should involve in-depth contact with all OIML Members in order to assess their regulatory needs, and also pre-packers and consumers should be consulted in order to take account of their needs. It would be the responsibility of each OIML Member to discuss these issues on a national basis with their industry and consumers, and ideally in the future industry would be represented at meetings concerning pre-packaging. TC 6 meetings should therefore be open to pre-packers and their various associations, and also to consumers' associations in order to have adequate (but concentrated) representation during TC 6's future work.

The issue of minimum quantity versus average quantity required further study in order to ascertain the position of all OIML Members in this regard.

The issue of OIML R 96 *Measuring container bottles* was also raised: it was decided that this Recommendation should also be revised in order to allow easier non-destructive control of bottles - this should be the object of a mutual acceptance process.

It was envisaged that the OIML quantity mark scheme would be voluntary: Member States would be able to decide whether they would participate or not, and hence accept the mark or not. Similarly, packers would be able to decide whether they would apply for an OIML mark or not.

This step-by-step approach was decided on during the Seminar, since attempting to draw up and implement a pre-packaging MAA immediately could prove to be too ambitious a project to start off with. It was further decided that TC 6 should develop a number of guidance documents, in particular guides for pre-packers; these guides would assist in the interpretation of the relevant OIML Recommendations. ■

CAPE TOWN

Working Group on Conformity to Type: Report

Dr Grahame Harvey
Working Group Chair

The Working Group on Conformity to Type met on the morning of 14 October 2006 in conjunction with the 41st CIML Meeting in Cape Town and was attended by eleven economies: Australia (2), Canada (2), Cuba, Finland, France, Germany, Japan, New Zealand, South Africa (2), United Kingdom and the United States (2). Three representatives from the Bureau were also present.

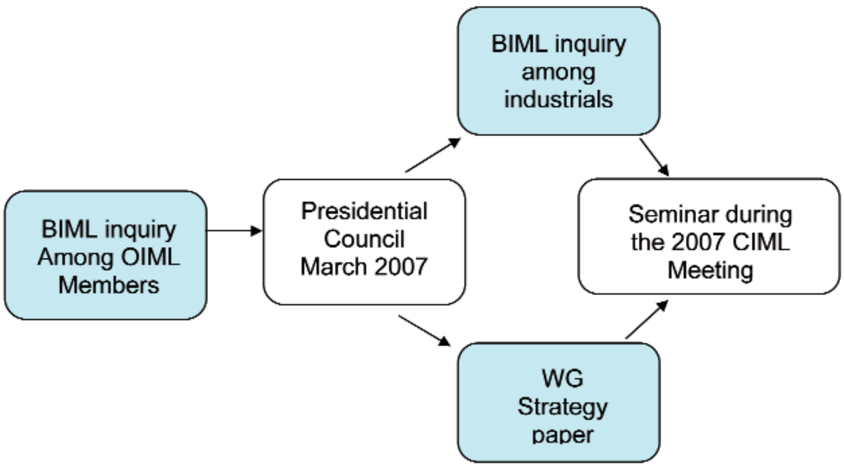
A brief discussion paper, circulated prior to the meeting, raised a number of issues to be addressed, including possible delivery and funding mechanisms. During the meeting there was wide-ranging discussion on various other topics including:

- the need for OIML coordination,
- delivery mechanisms (QA, sampling or both),
- possible linkages to the MAA or to the OIML Certificate System,
- possible funding mechanisms,
- the possible roles of Regional bodies,
- the application of sanctions, and
- the possible need for a pilot project.

The outcomes of the meeting and recommendations of the Working Group were:

- That the BIML would conduct an inquiry among CIML Members and OIML Corresponding Members to:
  - ascertain the level of non-conformance detected in the various economies, and
  - request information about the systems in place in the various economies to detect non-conformances.
- That the Working Group would develop a strategy paper to include the experiences of OIML Members and to describe options for achieving conformity to type.
- That the BIML would undertake an inquiry among instrument manufacturers through the OIML Certificates database to ascertain their views on a conformity to type program.
- That a seminar might be held on conformity to type in conjunction with the 2007 CIML Meeting in China. Such a seminar should involve participation by manufacturers and would address the responses from both surveys and be informed by the WG Strategy paper.
- That the Working Group should be maintained in its present form and not be converted into an OIML Technical Subcommittee.

The timetable for these activities is shown below.



OIML Certificate System:

Certificates registered 2006.08–2006.10

Up to date information (including B 3): www.oiml.org

The *OIML Certificate System for Measuring Instruments* was introduced in 1991 to facilitate administrative procedures and lower costs associated with the international trade of measuring instruments subject to legal requirements.

The System provides the possibility for a manufacturer to obtain an OIML Certificate and a test report indicating that a given instrument type complies with the requirements of relevant OIML International Recommendations.

Certificates are delivered by OIML Member States that have established one or several Issuing Authorities responsible for processing applications by manufacturers wishing to have their instrument types certified.

The rules and conditions for the application, issuing and use of OIML Certificates are included in the 2003 edition of OIML B 3 *OIML Certificate System for Measuring Instruments.*

OIML Certificates are accepted by national metrology services on a voluntary basis, and as the climate for mutual confidence and recognition of test results develops between OIML Members, the OIML Certificate System serves to simplify the type approval process for manufacturers and metrology authorities by eliminating costly duplication of application and test procedures.

This list is classified by Issuing Authority; updated information on these Authorities may be obtained from the BIML.

Cette liste est classée par Autorité de délivrance; les informations à jour relatives à ces Autorités sont disponibles auprès du BIML.

OIML Recommendation applicable within the System / Year of publication

Recommandation OIML applicable dans le cadre du Système / Année d'édition

Certified type(s)

Type(s) certifié(s)

► Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

R60/2000-NL1-02.02

Type 0765 (Class C)

Mettler-Toledo Inc., 150 Accurate Way, Inman, SC 29349, USA

The code (ISO) of the Member State in which the certificate was issued, with the Issuing Authority's serial number in that Member State.

Le code (ISO) indicatif de l'État Membre ayant délivré le certificat, avec le numéro de série de l'Autorité de Délivrance dans cet État Membre.

For each instrument category, certificates are numbered in the order of their issue (renumbered annually).

Pour chaque catégorie d'instrument, les certificats sont numérotés par ordre de délivrance (cette numérotation est annuelle).

Year of issue

Année de délivrance

Applicant

Demandeur

Système de Certificats OIML:

Certificats enregistrés 2006.08–2006.10

Informations à jour (y compris le B 3): www.oiml.org

Le *Système de Certificats OIML pour les Instruments de Mesure* a été introduit en 1991 afin de faciliter les procédures administratives et d'abaisser les coûts liés au commerce international des instruments de mesure soumis aux exigences légales.

Le Système permet à un constructeur d'obtenir un certificat OIML et un rapport d'essai indiquant qu'un type d'instrument satisfait aux exigences des Recommandations OIML applicables.

Les certificats sont délivrés par les États Membres de l'OIML, qui ont établi une ou plusieurs autorités de délivrance responsables du traitement des demandes présentées par des constructeurs souhaitant voir certifier leurs types d'instruments.

Les règles et conditions pour la demande, la délivrance et l'utilisation de Certificats OIML sont définies dans l'édition 2003 de la Publication B 3 *Système de Certificats OIML pour les Instruments de Mesure.*

Les services nationaux de métrologie légale peuvent accepter les certificats sur une base volontaire; avec le développement entre Membres OIML d'un climat de confiance mutuelle et de reconnaissance des résultats d'essais, le Système simplifie les processus d'approbation de type pour les constructeurs et les autorités métrologiques par l'élimination des répétitions coûteuses dans les procédures de demande et d'essai.

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Water meters intended for the metering of cold potable water
Compteurs d'eau destinés au mesurage de l'eau potable froide

R 49 (2003)

▶ Issuing Authority / *Autorité de délivrance*

Laboratoire National de Métrologie et d'Essais, Certification Instruments de Mesure, France

R049/2003-FR2-2006.02
Compteur d'eau destiné au mesurage de l'eau potable froide; Type D1 (CORONA M) classe 2
Sappel, 67 rue du Rhône, BP 160, F-68300 Saint-Louis Cedex, France

R049/2003-FR2-2006.03
Compteur d'eau destiné au mesurage de l'eau potable froide; Type C1 (AQUILA) classe 2
Sappel, 67 rue du Rhône, BP 160, F-68300 Saint-Louis Cedex, France

R049/2003-FR2-2006.04
Compteur d'eau destiné au mesurage de l'eau potable froide; Type B1 (AQUARIUS) classe 2
Sappel, 67 rue du Rhône, BP 160, F-68300 Saint-Louis Cedex, France

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

R049/2003-DE1-2006.01

Water meter intended for the metering of cold potable water. Type Smart™, SM 150 and SM 250 Series

Severn Trent Metering Services Ltd., Smeckley Wood Close, Chesterfield Trading Estate, Chesterfield S41 9PZ, United Kingdom

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic catchweighing instruments
Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique

R 51 (1996)

▶ Issuing Authority / *Autorité de délivrance*

National Weights and Measures Laboratory (NWML), United Kingdom

R051/1996-GB1-2006.01
HI 3600 TF, WI 3600 TF, CW 3600 TF, MI 3600 TF, LI 3600 TF
Digi Europe Limited, Digi House, Rookwood Way, Haverhill, Suffolk CB9 8DG, United Kingdom

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Metrological regulation for load cells (applicable to analog and/or digital load cells)
Réglementation métrologique des cellules de pesée (applicable aux cellules de pesée à affichage analogique et/ou numérique)

R 60 (2000)

▶ Issuing Authority / *Autorité de délivrance*

National Weights and Measures Laboratory (NWML), United Kingdom

R060/2000-GB1-2006.02
Alloy steel, nickel plated, compression strain gauge load cell
Applied Weighing International Ltd., Unit 5, Southview Park, Marsack Street, Caversham, Reading, Berkshire RG4 5AF, United Kingdom

▶ Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

R060/2000-NL1-2006.02 Rev. 1
Tension, S-Type load cell; Type CTL … A and CTL … B
Laumas S.r.l., via 1° Maggio n.6, I-43030 Basilcanova Parma, Italy

R060/2000-NL1-2006.09
Type DC 285
Arpège Master-K, 38 Ave des Frères Montgolfier, BP 186, F-69686 Chassieu Cedex, France

R060/2000-NL1-2006.11
Digital bending beam load cell. Type FIT/0...; FIT1...; FIT/4...
Hottinger Baldwin Messtechnik GmbH, Im Tiefen See 45, D-64293 Darmstadt, Germany

R060/2000-NL1-2006.12
Digital bending beam load cell. Type FIT/5...
Hottinger Baldwin Messtechnik GmbH, Im Tiefen See 45, D-64293 Darmstadt, Germany

R060/2000-NL1-2006.13
Shear beam load cell. Type SK
Scaime S.A., Z.I. de Juvigny, B.P. 501, F-74105 Annemasse Cedex, France

R060/2000-NL1-2006.14
Shear beam load cell. Type CSI...
Precia Molen, BP 106, F-07001 Privas Cedex, France

R060/2000-NL1-2006.15
Shear beam load cell. Type SBK...
Scaime S.A., Z.I. de Juvigny, B.P. 501, F-74105 Annemasse Cedex, France

R060/2000-NL1-2006.16
Shear beam load cell. Type SPS14
Soehnle-Waagen GmbH + Co., Fornsbacher Straße 27-35, D-71540 Murrhardt, Germany

R060/2000-NL1-2006.17
Shear beam load cell. Type SWRC...
Scaime S.A., Z.I. de Juvigny, B.P. 501, F-74105 Annemasse Cedex, France

R060/2000-NL1-2006.18 Rev. 1
Shear beam load cell. Type HSX- A,,
Keli Electric Manufacturing (Ningbo) Co. Ltd., 199 Changxing Road, Jiangbei District, Ningbo City, P.R. China

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

R060/2000-DE1-2006.02
Strain gauge single point load cell. Type PW15xH...
Hottinger Baldwin Messtechnik GmbH, Im Tiefen See 45, D-64293 Darmstadt, Germany

▶ Issuing Authority / *Autorité de délivrance*

DANAK The Danish Accreditation and Metrology Fund, Denmark

R060/2000-DK1-2006.04
Compression, strain gauge load cell. Type BS
ESIT Electronics, Mühürdar Cad. No. 91, Kadiköy, TR-81300 Istanbul, Turkey

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic gravimetric filling instruments
Doseuses pondérales à fonctionnement automatique

R 61 (1996)

▶ Issuing Authority / *Autorité de délivrance*

National Weights and Measures Laboratory (NWML), United Kingdom

R061/2004-GB1-2006.01 Rev. 1
PN Series Weigher
Prins UK Ltd., Unit 140, Hartlebury Trading Estate, Kidderminster, Worcestershire DY104JB, United Kingdom

R061/2004-GB1-2006.02
BTH-MFS Net weigher
BTH UK Ltd., Unit 4 Butterly Croft Business Center, Whiteley Road, Ripley, Derbyshire DE5 3QL, United Kingdom

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Nonautomatic weighing instruments
Instruments de pesage à fonctionnement non automatique

R 76-1 (1992), R 76-2 (1993)

▶ Issuing Authority / *Autorité de délivrance*

International Metrology Cooperation Office, National Metrology Institute of Japan (NMIJ) National Institute of Advanced Industrial Science and Technology (AIST), Japan

R076/1992-JP1-2006.04
Non-automatic weighing instrument; Type UDS-1V-WP, UDS-1V II - WP, TCW-WP
Yamato Scale Co., Ltd., 5-22 Saenba-cho, 673-8688 Akashi City, Japan

R076/1992-JP1-2006.05
Type MC-180MA
Tanita Corporation (Brand names: Tanita, Rhewa, Wunder), 14-2, 1-Chome, Maeno-cho, Itabashi-ku, 147-8630 Tokyo, Japan

▶ **Issuing Authority / *Autorité de délivrance***

National Weights and Measures Laboratory (NWML), United Kingdom

R076/1992-GB1-2006.03
Virtual Measurement & Control VC-203 indicating device
Virtual Measurements & Control Inc. (USA), 1040A N. Dutton Ave, CA 95401 Santa Rosa, United States

▶ **Issuing Authority / *Autorité de délivrance***

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

R076/1992-NL1-2006.05 Rev. 1
Non-automatic weighing instrument; Type GEW... / MEP... / MEPL...
Kingship Weighing Machine Corp., 739 Renhua Road, Dali City, Taichung, Taiwan 412, Chinese Taipei

R076/1992-NL1-2006.17
Nonautomatic weighing instrument. Type BJ160
Precisa Instruments A.G., Moosmattstraße 32, CH-8953 Dietikon, Switzerland

R076/1992-NL1-2006.26
Nonautomatic weighing instrument. Type MHS2200/MHS2400/MHS2500/MHS2600
Charder Electronic Co., Ltd., 103 Kuo Chung Road, Dah Li City, Taichung Hsien 412, Chinese Taipei

R076/1992-NL1-2006.27
Nonautomatic weighing instrument. Type Hytech 45
Hytech International, De Roysloot 2, NL-2231 NZ Rijnsburg, The Netherlands

R076/1992-NL1-2006.28
Nonautomatic weighing instrument. Type SI-series
Acom Inc., A#479 Tonghoon Bldg., Uijongbu - 2 Dong, Uijongbu-Si, 480-012 Kyungki-do, Korea (R.)

R076/1992-NL1-2006.29
Nonautomatic weighing instrument. Type NE-Series
Snowrex International Co. Ltd., 2F No. 9, Lane 50, Sec. 3, Nan-Kang Road, Taipei, Chinese Taipei

R076/1992-NL1-2006.30
Nonautomatic weighing instrument. Type NP-Series
Snowrex International Co. Ltd., 2F No. 9, Lane 50, Sec. 3, Nan-Kang Road, Taipei, Chinese Taipei

R076/1992-NL1-2006.31
Nonautomatic weighing instrument. Type SW-1S/1C/1W
CAS Corporation, CAS Building #440.1 Sungnae-Dong, Kangdong-KU, Seoul, Korea (R.)

R076/1992-NL1-2006.32
Nonautomatic weighing instrument. Types WB-100...MA;WB-110...MA;BC-420MA (STMA); DC320MA (STMA).
Tanita Corporation (Brand names: Tanita, Rhewa, Wunder), 14-2, 1-Chome, Maeno-cho, Itabashi-ku, 147-8630 Tokyo, Japan

R076/1992-NL1-2006.33
Nonautomatic weighing instrument. Family of type: IND22x (BBA)-YYYZWWW
Mettler-Toledo (Changzhou) Precision Instruments Ltd., 5 HuaShanZhong Lu, ChangZhou, JiangSu, P.R. China

R076/1992-NL1-2006.34
Non-automatic weighing instrument. Type SM-800.. / SM-880..
Teraoka Weigh-System PTE Ltd., 3A Tuas Avenue 8, 639218 Singapore, Singapore

R076/1992-NL1-2006.35
Non-automatic weighing instrument. Type SM-780...
Teraoka Weigh-System PTE LTD., 4 Leng Kee Road, #06-01 SIS Building, 159088 Singapore, Singapore

R076/1992-NL1-2006.36
Non-automatic weighing instrument. Type JPG / JWG
Jadever Scale Co. Ltd., No. 5, Wu-Chuan 2 RD., Wu-Ku Hsiang, Taipei Hsien, Chinese Taipei

R076/1992-NL1-2006.37
Non-automatic weighing instrument. Type Discovery
Ohaus Corporation, 19A Chapin Road, NJ 07058-9878 New Jersey, Pine Brook, New Jersey, United States

R076/1992-NL1-2006.38
Non-automatic weighing instrument. Type bTwin
Mettler-Toledo (Changzhou) Precision Instruments Ltd., 5 HuaShanZhong Lu, ChangZhou, JiangSu, P.R. China

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

R076/1992-DE1-2002.04 Rev. 2
Nonautomatic electromechanical weighing instrument. Types CE...

Bizerba GmbH & Co. KG, Wilhelm-Kraut-Straße 65, D-72336, Balingen, Germany

R076/1992-DE1-2006.08
Non-automatic mechanical weighing instrument with lever system. Type M756x0

SECA GmBH & Co. kg., Hammer Steindamm 9-25, D-22089 Hamburg, Germany

▶ Issuing Authority / *Autorité de délivrance*

Russian Research Institute for Metrological Service (VNIIMS)

R076/1992-RU1-2006.01
Type ABP-B-CD

Avitec-Plus Ltd., 122, Malisheva str, Yekaterinburg, Sverdlovsk Region 620078, Russian Federation

▶ Issuing Authority / *Autorité de délivrance*

Office Fédéral de Métrologie, Switzerland

R076/1992-CH1-2006.01
Nonautomatic electromechanical wheel load weighing instrument. Type WL-103

HAENNI Wheel Load Scales, Bernstrasse 59, CH-3303 Jegenstorf, Switzerland

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic level gauges for measuring the level of liquid in fixed storage tanks
Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de stockage fixes

R 85 (1998)

▶ Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

R085/1998-NL1-2006.01
Automatic level gauge for measuring the level of liquid in storage tanks, model FMR 540 with horn antenna DN100 or with parabolic antenna DN200

Endress + Hauser GmbH + Co., Haupstraße 1, D-79689 Maulburg, Germany

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Fuel dispensers for motor vehicles
Distributeurs de carburant pour véhicules à moteur

R 117 (1995) + R 118 (1995)

▶ Issuing Authority / *Autorité de délivrance*

International Metrology Cooperation Office, National Metrology Institute of Japan (NMIJ) National Institute of Advanced Industrial Science and Technology (AIST), Japan

R117/1995-JP1-2002.01 Rev. 1
Fuel dispenser for motor vehicles, Tatsuno NEO series

Tatsuno Corporation Tokyo, 2-12-13, Shibaura Minato-ku, 108-8520 Tokyo, Japan

R117/1995-JP1-2006.01
Fuel dispenser for motor vehicules, Multi X series

Tatsuno Corporation Tokyo, 2-12-13, Shibaura Minato-ku, 108-8520 Tokyo, Japan

Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

R117/1995-NL1-2006.02
Type Global Vista Oil Mix 3/G3000/O
Dresser Wayne Pignone, Limhamnsvägen 109, Box 300 49, SE-200 61 Malmö, Sweden

R117/1995-NL1-2006.03
Type Global Century Oil Mix
Dresser Wayne Pignone, Limhamnsvägen 109, Box 300 49, SE-200 61 Malmö, Sweden

Issuing Authority / *Autorité de délivrance*

Russian Research Institute for Metrological Service (VNIIMS)

R117/1995-RU1-2006.04
Fuel dispenser, Nara 5000
Closed Joint-Stock Company "Nara", 1, Polevaya, Serpukhov, 142 207 Moscow Region, Russian Federation

R117/1995-RU1-2006.05
Fuel dispenser Nara 4000
Closed Joint-Stock Company "Nara", 1, Polevaya, Serpukhov, 142 207 Moscow Region, Russian Federation

R117/1995-RU1-2006.06
Fuel dispenser Nara 28B
Closed Joint-Stock Company "Nara", 1, Polevaya, Serpukhov, 142 207 Moscow Region, Russian Federation

R117/1995-RU1-2006.07
Fuel dispenser Nara 28V
Closed Joint-Stock Company "Nara", 1, Polevaya, Serpukhov, 142 207 Moscow Region, Russian Federation

R117/1995-RU1-2006.08
Fuel Dispensers SWADES I and SWADES II Series
Aplab Ltd., Plot-12, TTC Industrial Area, Digha, Airo Post, 400 708 Navi Mumbai, India

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Multi-dimensional measuring instruments
Instruments de mesure multidimensionnels

R 129 (2000)

Issuing Authority / *Autorité de délivrance*

Norwegian Metrology Service, Norway

R129/2000-NO1-2006.03
Dimensioner: Cargoscanner CND910; Display: Cargoscanner CS2200
Mettler-Toledo Cargoscan AS, Grenseveien 65/67, N-0663 Oslo, Norway

OIML CERTIFICATE SYSTEM

List of OIML Issuing Authorities (by Country)

The list of OIML Issuing Authorities is published in each issue of the OIML Bulletin. For more details, please refer to our web site: www.oiml.org/certificates. Changes since the October 2006 issue of the Bulletin are marked in red.

AUSTRALIA

AU1 - National Measurement Institute	R 50	R 51	R 60	R 76	R 85	R 106
	R 107	R 117/118	R 126	R 129		

AUSTRIA

AT1 - Bundesamt für Eich- und Vermessungswesen	R 50	R 51	R 58	R 61	R 76	R 85
	R 88	R 97	R 98	R 102	R 104	R 106
	R 107	R 110	R 114	R 115	R 117/118	

BELGIUM

BE1 - Metrology Division	R 76	R 97	R 98

BRAZIL

BR1 - Instituto Nacional de Metrologia, Normalização e Qualidade Industrial	R 76

BULGARIA

BG1 - State Agency for Metrology and Technical Surveillance	R 76	R 98

CHINA

CN1 - State General Administration for Quality Supervision and Inspection and Quarantine	R 60	R 76	R 97	R 98

CZECH REPUBLIC

CZ1 - Czech Metrology Institute	**R 49**	R 76	**R 81**	**R 85**	**R 105**	R 117/118

DENMARK

DK1 - The Danish Accreditation and Metrology Fund	R 50	R 51	R 60	R 61	R 76	R 98
	R 105	R 106	R 107	R 117/118	R 129	
DK2 - FORCE Technology, FORCE-Dantest CERT	R 49					

FINLAND

FI1 - Inspecta Oy	R 50	R 51	R 60	R 61	R 76	R 85
	R 106	R 107	R 117/118			

FRANCE

FR1 - Bureau de la Métrologie — *All activities and responsibilities were transferred to FR2 in 2003*

FR2 - Laboratoire National de Métrologie et d'Essais	R 31	R 49	R 50	R 51	R 58
	R 60	R 61	R 76	R 85	R 88
	R 97	R 98	R 102	R 105	R 106
	R 107	R 110	R 114	R 115	R 117/118
	R 126	R 129			

GERMANY

DE1 - Physikalisch-Technische Bundesanstalt (PTB)	R 16	R 31	R 49	R 50	R 51
	R 58	R 60	R 61	R 76	R 88
	R 97	R 98	R 102	R 104	R 105
	R 106	R 107	R 110	R 114	R 115
	R 117/118	R 128	R 129	R 133	

HUNGARY

HU1 - Országos Mérésügyi Hivatal	R 76

JAPAN

JP1 - National Metrology Institute of Japan	R 60	R 76	R 115	R 117/118

KOREA (R.)

KR1 - Korean Agency for Technology and Standards	R 76

THE NETHERLANDS

NL1 - NMi Certin B.V.	R 31	R 49	R 50	R 51	R 60
	R 61	R 76	R 81	R 85	R 97
	R 105	R 106	R 107	R 117/118	R 126
	R 129	R 134			

NEW ZEALAND

NZ1 - Ministry of Consumer Affairs, Measurement and Product Safety Service	R 76

NORWAY

NO1 - Norwegian Metrology Service	R 50	R 51	R 61	R 76	R 105
	R 106	R 107	R 117/118	R 129	

POLAND

PL1 - Central Office of Measures	R 76	R 98	R 102

ROMANIA

RO1 - Romanian Bureau of Legal Metrology	R 97	R 98	R 110	R 114	R 115

RUSSIAN FEDERATION

RU1 - Russian Research Institute for Metrological Service	R 31	R 50	R 51	R 58	R 60
	R 61	R 76	R 85	R 88	R 93
	R 97	R 98	R 102	R 104	R 105
	R 106	R 107	R 110	R 112	R 113
	R 114	R 115	R 117/118	R 122	R 126
	R 128	R 129	R 133		

SLOVAKIA

SK1 - Slovak Legal Metrology (Banska Bystrica)	R 76	R 117/118

SLOVENIA

SI1 - Metrology Institute of the Republic of Slovenia	R 76

SPAIN

ES1 - Centro Español de Metrología	R 51	R 60	R 61	R 76	R 97
	R 98	R 126			

SWEDEN

SE1 - Swedish National Testing and Research Institute AB	R 50	R 51	R 60	R 61	R 76
	R 85	R 98	R 106	R 107	R 117/118

SWITZERLAND

CH1 - Swiss Federal Office of Metrology and Accreditation	R 16	R 31	R 50	R 51	R 60
	R 61	R 76	R 97	R 98	R 105
	R 106	R 107	R 117/118		

UNITED KINGDOM

GB1 - National Weights and Measures Laboratory	R 49	R 50	R 51	R 60	R 61
	R 76	R 85	R 98	R 105	R 106
	R 107	R 117/118	R 129	R 134	
GB2 - National Physical Laboratory	R 97				

UNITED STATES

US1 - NCWM, Inc.	R 60	R 76

VIETNAM

VN1 - Directorate for Standards and Quality (STAMEQ)	**R 76**

13° CONGRÈS INTERNATIONAL DE MÉTROLOGIE
13th INTERNATIONAL METROLOGY CONGRESS
Innovation and knowledge transfer / Innovation et transfert de connaissances

PRESS RELEASE
[31 OCTOBER 2006]

13th International Metrology Congress

18-21 June 2007 – Lille, France

The French College of Metrology is organizing the 13th International Metrology Congress with the support of the National Metrology and Testing Laboratory (LNE) and the Nederlands Meetinstituut (NMi) from 18 through 21 June 2007.

In the wake of the outstanding success of the 2005 event, the ambitious attendance objective for 2007 is between 800 and 1000 European and International participants, including specific partnerships with a number of Dutch, Belgian, Swedish and UK bodies and, once again, the backing of the OIML.

Industrial support

Support has also been secured from two leading metrology industrials as Congress organization partners: Stork Intermes, a metrology service company, and GE Sensing, a manufacturer of flow, pressure and humidity measuring instruments, proving the interest the event is generating in France as well as in Europe.

New features for the 2007 event

Periods of two hours have been set aside each day during which there will be no conference sessions, giving delegates the opportunity to spend even more time to visit the exhibition and poster sessions;

The official Congress opening will take place on Monday 18 June in the evening and will be followed by a Round Table, open to the public, on the theme "Metrology and road safety".

Congress Exhibition

An exhibition of the latest technical developments will bring together the major actors in the field of measurement: equipment manufacturers, service companies, training centers, international bodies and laboratories, and the scientific press.

The exhibition will comprise a total of 70 stands (each 6 to 9 m^2), a reception area, an open-bar meeting area, poster sessions and a dining area.

To date, 40 % of the exhibition area has been reserved by Aérométrologie, Calibration on Line, Capacitec Europe, CAST, CETIAT, E2M, Félix Informatique, GE Sensing (The Netherlands), the Institut Méditerranéen de la Qualité, the LNE, Mecasem, Metrocal (Tunisia), Nikon France, le NMI (The Netherlands), Pyrocontrôle, Renishaw, Rotronics, Sartorius, Stork Intermes (Belgium), Symétrie, and Trescal.

Congress Program

- 170 oral presentations and poster sessions;
- 4 Round Tables on questions of interest to industrials; and
- Technical visits to companies in the region.

For full details of the program, technical visits, presentations, poster sessions, etc. please visit the Congress web site or telephone the Organizing Committee.

Fees

Between 360 and 720 euros (+ VAT 19.6 %) according to the number of days (discount available for CFM Members, please inquire).

Collège Français de Métrologie
Tél: 04 67 06 20 36
info@cfmetrologie.com

www.cfmetrologie.com

The OIML is pleased to welcome the following new

CIML Members

- **China:**
  Mr. Pu Changcheng
- **Cyprus:**
  Mr. Ntinos Hadjiconstantinou
- **India:**
  Mr. Mathurbootham

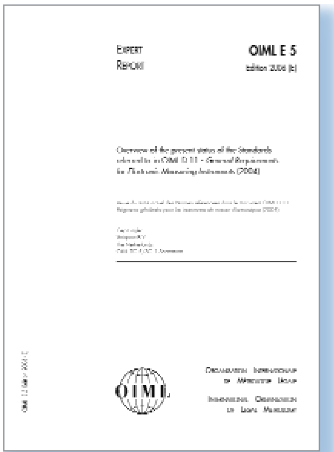
OIML Meetings

8–9 March 2007 - Vienna, Austria (To be confirmed)

TC 8/SC 1 Static volume and mass measurement

October 2007 - Shanghai, P.R. China (Dates to be confirmed)

42nd CIML Meeting and Associated Events


Expert Report
OIML E 5
Edition 2006 (E)

Now available in English and French:

OIML E 5 (Edition 2006)

Overview of the present status of the Standards referred to in OIML D 11 *General Requirements for Electronic Measuring Instruments* (2004)

www.oiml.org/publications

www.oiml.org
Stay informed

Committee Drafts

Received by the BIML, 2006.08 – 2006.11

Revision R 59: Moisture meters for cereal grains and oilseeds	E	4 CD	TC 17/SC 1	CN
Revision D 16: Principles of assurance of metrological control	E	1 WD	TC 3/SC 2	CZ
Revision of ISO 3930/R 99-1 and ISO 3930/R 99-2	E	1 WD	TC 16/SC 1	NL
Automated refractometers: Methods and means of verification	E	2 CD	TC 17/SC 2	RU
Revision R 80: Road and rail tankers with level gauging. Part 1: Technical and metrological requirements	E	3 CD	TC 8/SC 1	AT

Call for papers

OIML Members
RLMOs
Liaison Institutions
Manufacturers' Associations
Consumers' & Users' Groups, etc.

- Technical articles on legal metrology related subjects
- Features on metrology in your country
- Accounts of Seminars, Meetings, Conferences
- Announcements of forthcoming events, etc.

The **OIML Bulletin** is a forum for the publication of technical papers and diverse articles addressing metrological advances in trade, health, the environment and safety - fields in which the credibility of measurement remains a challenging priority. The Editors of the Bulletin encourage the submission of articles covering topics such as national, regional and international activities in legal metrology and related fields, evaluation procedures, accreditation and certification, and measuring techniques and instrumentation. Authors are requested to submit by e-mail:

- a titled, typed manuscript in Word;
- any relevant photos, illustrations, diagrams, etc.;
- a photograph of the author(s) suitable for publication together with full contact details: name, position, institution, address, telephone, fax and e-mail.

Note: Electronic images should be minimum 150 dpi, preferably 300 dpi.

Papers selected for publication will be remunerated at the rate of 23 € per printed page, provided that they have not already been published in other journals. The Editors reserve the right to edit contributions for style, space and linguistic reasons and author approval is always obtained prior to publication. The Editors decline responsibility for any claims made in articles, which are the sole responsibility of the authors concerned. Please send submissions to:

The Editor, OIML Bulletin
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(chris.pulham@oiml.org)